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April 2, 2002

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OIPE APR 15 2002 PATENT & TRADEMARK OFFICE

Renewed Petition under 37 CFR 1.137 (a)
In re of Appl. No. 08/860,182, filed 06/02/97
Commissioner's letter (E25; P32), mailed on Feb. 19, received on March 12

In order to request Board of Patent Appeals and Interferences to investigate the case, to object to the decision of Mrs Beverly M. Flanagan, Supervisory Petitions Attorney (E25 or P32) and to fully meet the condition to grant a petition as well as a patent I take into account all the facts and circumstances in regard to all correspondences, listed in an attached, updated Chronological Table of Papers, and deliver the following evidences for unavoidable delay and the failure of the Examiner to properly, prudently, diligently prosecute the amended Appls as well as to understand Technical Mechanics etc.

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History of the fifth OAS (Office Action Summary)

When scrutinizing the statement of attached P32P "*the Examiner, Mr Jason Morrow, gave the Applicant ... by issuing the fifth OAS (E20; P29)*", it is apparent that

1. the fifth OAS (E20), a response to the first submittal (E0), filed 06/02/97, is an evidence that the Examiner has failed to properly, prudently, diligently prosecute the amended Appls or submittals (E16 to E19), filed 11/04/99 to 11/10/99,
2. he has repeatedly rejected
   - terms and phrases, which are not listed in the submittals (E17 to E19) and turn out to be common US-phrases, listed in attached "US-Ph1" and "US-Ph2",
   - amended drawings (E12), which were already approved by him and his supervisor, Mr D. Glenn Dayoan (E13),
   - amended Claims and Abstract (E10, E11), which were already approved by them in the fourth OAS (E13), in which they **only** requested me to amend the Description,
3. he has ignored the amended terms, phrases, Description, drawings as well as Claims,
4. he did not examine the submittals (E17 to E19) at all, but just copied the first OAS (E1), a few sections of which were erased and a few sections were supplemented thereto, and set up a new date 04/06/2000 on the merely updated copy, which is the fifth OAS,

thus documenting the failure to properly, prudently, diligently prosecute the Appls. despite being reminded by phone of the approval (E13) and a careful prosecution. Evidently, he has ignored the submittals (E16 to E19) as well as my requests by mailing me the fifth OAS (E20), *which is not the result of the prosecution thereof at all.*

A host of patent attorneys, if they represent me at USPTO, could never resolve the problems he has been creating.

Analysis

First Evidence for Approval on amended Claims and Abstract and Suggestion to amend Description

Both Examiners have asserted their full approval, stating "*Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn*" (E13), on the amended Claims and Abstract (E10 to E11), and

solely requested me to amend the Description (E13). Later on, Mr Morrow sent me a fax (attached E15) consisting of a eight-page part of the Description (E10), in which he made changes, and of the *following coversheet* showing that changes, his instructions to rewrite, eliminate and correct, suggestions to review and take them as examples for the amended Description (E16 to E19) as well as his request to fax him the revised draft (E16, E17b-d):

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• **Comments:** Go, please review the changes I have made to the specification. I have not corrected the entire document, but I have tried to give you an idea of the changes I would like you to make on pages 1-7. Try to eliminate the references to specific vehicle crashes and instead concentrate on the general reasons why the invention is unobvious and useful. You do not need to use evidence to support your conclusions in the Background of the Invention. Your statement and oath is evidence enough. The purpose of the Patent is not to scrutinize your research, but merely to describe your invention such that someone of ordinary skill will be able to understand and reproduce it.

Accordingly, the Description of the Preferred Embodiments section of the Patent is more important. The purpose of this section is not to simply list the parts. Please avoid doing this. It is unnecessary. Do not explain in words what can be seen in the drawings. Instead, explain the reasoning for the invention to be constructed in the manner it is and the function of the various parts. It is necessary to explain clearly how the invention works. Avoid listing parts and stating what is attached to what. This section should be NARRATIVE and EASILY UNDERSTADABLE. Do not use "listing" as shown in lines 17-31 of page 13.

In short, please revise the entire specification, removing unnecessary information from the Background of the Invention and concentrating on the Description of the Preferred Embodiments. Keep in mind that NO NEW MATTER may be entered into the case at this point.

When you have completed the revision of the specification, please contact me again and let me know when you will fax me the revised draft to (703) 308-3297.

The revised draft or amended Description (attached E16, 17b-d) was faxed twice to him upon his repeated instructions (attached E17a):

• **Comments:** Go, please do not send your draft in by mail. This will only serve to clutter the case further. Please attempt to re-fax your specification. The fax machine yesterday ran out of toner and for this reason didn't accept all of your fax transmission. Contact me again before you attempt to re-fax.

Please investigate the reason for his written and oral requests of sending to him the amended Description not by mail, but by fax via his fax machine, I assume, for his own file. See Summary.

The approval of the amended Claims, Abstract and phrases is substantiated by the fourth OAS (E13) and his requests by fax and by phone to fax to him **only** the amended Description in order to wholly revise the Appl., on which a patent will be granted!

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Additionally, the amended Appl. (Description, Claims and Abstract) with the letter (attached E18) was sent registered to USPTO. A revised Description was faxed again (attached E19). Despite having received the amended Description (attached E19A), Claims and Abstract (E10 to E11, E13) he has issued the fifth OAS (E20), a copy of the first OAS (E1) plus some changes, thus reviving the rejections after a lapse of 16 months, impeding the progress of the work to such an extent that it threatens to become a never-ending task. See Summary.

Second and Third Evidence for skill and experience of examiners in the same subjects and classification

Skilled examiners of EPO (European Patent Office) immediately granted a patent on my inventions European Patent 0869878 B1, the family member of which is Appl. No. 08/860,182, and Mr Brown of CIPO (Canadian Patent Office), having understand my written and oral explanation and recognized the superiority of my patents to those of Townseed, shortcomings of which are disclosed in the Description (E5, E8, E10, E16 to E19). Mr Brown sent me a proposal for the Claims, which, I amended, were submitted to him. In contrast to Mr Morrow he, being a skilled examiner, will grant patent thereon within 15 months. See enclosed "CIPO".
In contrary to CIPO and Mr Brown Mr Morrow rejected the US-phrases (E1 and E20), which are common in the US Patent Docs, listed in attached US-Ph1 and US-Ph2.
Any careful, diligent Examiner would avoid to repeat erroneous, unqualified rejections of phrases, in particular, when most of them were already replaced by other phrases, written in E16 to E19,

of the amended drawings, although correct, and of the amended Claims, although correct and approved.
Contrarily, Mr. Dennis Pedder of USPTO demonstrated his skill by prosecuting my other Appl. with diligence and avoiding unqualified rejections as well as objections.

Fourth Evidence for wrong verdicts of the Commissioner in pp. 3 of letter (E25; P32)

I, being an applicant, have always exercised diligence, prudence and meticulousness, generally observed and judged by skilled examiners of the German, European and Canadian Patent Office who have been eager to grant patents on a number of my Patent Appls, some of which will be issued,

- elf[1] from the DPMA (German Patent Office),
- seven[2] from the EPO and
- two[3] from the CIPO

in seven years thanks to applicability, feasibility and novelty of my inventions and their skill to perceive new features, far superior to the prior art.
In order to show how difficult to have patents granted by DPMA and EPO on inventions the DPMA as well as EPO will never grant patent on BMW's DE 4330620 and EP 0642940 A1 lack of novelty and due to inapplicability. Contrarily, USPTO has granted a patent on the family member US 5,297,841 thereof, shortcomings of which are unravelled in the Description (E5, E8, E10, E16 to E19) and responsible for ejection and compression of passengers in real-world accidents. I own photos thereof. Being a very diligent inventor, I am used to having a patent granted within the shortest period of six months, which is a world-record, on my inventions ref. to German Patent Doc. DE 100 10 415 C1 (WO/01/64485) with over 30 Claims. In this year EPO has granted patents on four voluminous patent Appls. with, totally, far over 200 Claims within the shortest prosecution time.
I may propose the Commissioner to correct the verdicts as well as conclusion that

- Mr Morrow has failed to diligently, prudently, properly prosecute the amended Appls (E17 to E19), understand Technical Mechanics, Kinematics, Manufacturing as well as Assembling etc. and perceive the feasibility and novelty of my inventions while requesting to fax the amended Appls to him and
- the conclusion "*the application became abandoned*" in pp. 6 solely results from his failure.

Fifth Evidence for capricious actions of Mr Morrow

Neither DPMA nor EPO would grant patent on Townseed's interengaging assembly, subjected to five clearances, due to the first invention of Dr. Reichenbach, whose interengaging assembly ref. to German Patent Doc. DE 1755611, which I submitted to him, includes a cone-shaped key and the mating receptacle, subjected to two clearances. However, the problem of clearances remains unresolved. When the tolerances between mating members of door lock are perfectly adjusted the key and mating receptacle must be in loose interengagement. After more than two decades Daimler Chrysler has stopped the production of Dr. Reichenbach's interengaging assemblies.
In order to resolve the deficiencies the two clearances of my interengaging assembly ref. to 08/860,182 can be reduced to minimum tolerances by an adjusting mechanism, which is a novelty. Contrarily, Townseed's adjusting mechanisms by injecting hardenable resin pose the danger of smearing the vehicle body and doors and new car-buyers rejecting the cars. Townseed's interengaging assemblies will never go into production, while mine is being investigated by several car manufacturers, whose engineers and skilled Examiners are aware of

- additional costs resulting from the injection of hardenable resin, the necessity for cleaning the smeared resin on vehicle parts, the time to rework and repaint them, during which the assembly line must be stopped,

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[1] DE 19549378 C2, DE 19655051 C2, DE 196 55 146 C2, DE 19749780 C2, DE 19758497 C2, DE 19758498 C2, DE 19615985 C1, DE 19636167 C1, DE 19711392 C1, DE 10010415 C1, DE 19549379
[2] EP 0869878 B1, EP 0844939 B1, EP 1037773 B1, EP 1037771 B1, WO/00/69702, WO/01/38128, WO/01/64485
[3] 2,220,872, 2,236,816

- a high number of clearances, totally 33 per door (E5), which must be adjusted to minimum tolerances, hence, time-consuming and costly work, and hardenable resin coatings which are incapable of sustaining large forces, thus resulting in *oversized* clearances,
- passenger ejection linked to door detachment, when the interengaging assemblies are disengaged due to a large number of *oversized* clearances in real-world accidents, and
- high reject rate and rejections, which are expected among unsatisfied car owners.

When changing his view he found a **new** reason to reject the amended Claims, already approved (E13), by claiming that **Pavlik's** interengaging assemblies **without** adjusting mechanism (US 4,307,911), listed in pp. 17 of the fifth OAS (E20), are *"far superior"* to my interengaging assemblies **with** mechanical adjusting mechanisms. If his actions were not **capricious**, **equal** opportunities, which the US-Government propagates, were applied and he were **familiar** with the US-patent prosecuting procedure, Technical Mechanics etc., why has he

- neither **dismissed** *Townseed's* request to be granted a patent nor **revoked** *Townseed's* patent US 5,806,917 due to **Pavlik's** interengaging assemblies, *"far superior" to Townseed's*, and the **same** rejections of US-phrases, used in the Description and Claims, and those shortcomings
- nor **understand** Pavlik's, Townseed's and Fiat's shortcomings, listed in attached "ABUSE", representing the sections of the amended Description (E17 to E19) and all previous Descriptions, and shortcomings of other prior art, disclosed therein, as well as disengagement of all conventional interengaging assemblies resulting in the failure of passenger protection, substantiated by the documents, police accident-reports, photos and explanatory letters (E0, E3, E5, 11/06/98) I supplied to him, in real-world accidents?

Sixth Evidence for capricious actions of Mr Morrow

PTC's and Commissioner's allegations (E22, E25) that

"the Examiner determined that the application (E19) was so replete with errors that more changes would be needed .....(attached "P32P")"

are wrong because

- Mr Brown, having properly examined the same Appl. (E19), did have understand it,
- Mr. Dennis Pedder of USPTO and all the Examiners of CIPO, DPMA and EPO and BPO (British Patent Office), having examined the phrases of my Appls, have never made the above-mentioned allegations, and
- Mr Morrow is used to repeating the objected phrases of the **first** submittal (E0), which were already amended into the amended phrases (attached "US-Ph1" and "US-Ph2") of the Appls (E12, E16 to E19), thus
  - ⇒ creating a since Aug. 08, 98 never-ending paperwork,
  - ⇒ substantiating the fifth OAS (E20), which was replete with errors that such wrong verdicts, being repeated, are unacceptable and contradict to CIPO's to grant a patent on the same Appl., and
  - ⇒ justifying to make a Conclusion, written in attached "US-Ph2", as well as investigate his wrong verdicts and failure to diligently, prudently, properly prosecute the amended Appls (E16 to E19).

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Summary

When

1. an Examiner has repeated the rejection of the objected phrases of the **first** submittal (E0), most of which such as post section, side rail, latch mechanism, striker, washer, screw, sleeve etc. are common, hence, found in the US-, EP-, British Patent Docs., Webster and/or Oxford Dictionaries, and the remaining is not existing anymore, and failed to diligently, prudently, properly examine the amended phrases of the successive, amended submittals (~~E12~~, E16 to E19) despite being reminded several time to diligently, prudently, properly prosecute them, and
2. no objections to the same Appl. are registered in the Examination Reports of EPO and CIPO, whose Examiner has properly examined the same, amended phrases thereof (attached "CIPO")

⇒ his Examination Reports as well as Office Action Summaries are replete with errors,

⇒ he, having examined the ancient submittal (E0), not the recent ones (E16 to E19), has violated the prosecuting procedure of any Patent Office as well as USPTO and

⇒ he has disqualified himself for the job.

It is apparent that

- in contrary to *all diligently, prudently prosecuting* Examiners of CIPO, EPO and DPMA who have needed far shorter prosecution time to grant patents on my inventions thank to their skill, experience and ability to perceive the shortcomings of all prior art, disclosed in my Appls, and the failure thereof, disclosed therein and substantiated by police accident-reports, photos and/or explanatory letters, in real-world accidents, Mr Morrow would reject ***any response***, if *US-patent attorneys or I file*, to the fifth OAS by mailing a new OAS, a copy of the first OAS (E1) plus some changes, in which he would cite **another** prior art such as BMW's US 5,297,841, Fiat's US 3,819,228 or interengaging assemblies, which Dr. Reichenbach invented in 1960, and **repeat** his since Aug. 08, 98 never-ending rejections, which are unqualified,
- he is unfamiliar with the US-phrases, US-patent prosecuting procedure, Technical Mechanics, Kinematics, Manufacturing as well as Assembling etc., while three skilled Examiners of EPO needed six months to grant a patent on EP 0869878 B1 and Mr Brown, skilled Examiner of CIPO, having *prudently, properly* examined the **same** amended Appls, came to the conclusion within 15 months to grant a patent on CA 2,220,872, which and Appl. No. 08/860,182 are the family members thereof, and
- the abandonment of the Appl., the unavoidable delay, the delay to have a patent as well as the since Aug. 08, 98 never-ending paperwork result from his failure and capricious actions,

thus

⇒ necessitating an investigation on the interferences, his capricious actions, imprudent prosecution, failure, requests to fax him the amended Description, Claims and Abstract and the purpose thereof, I presume, for his private use and own file and

⇒ justifying to grant a petition as well as a patent on Appl. No. 08/860,182.

Upon the request of CIPO to inform the status of Appl. No. 08/860,182 I shall send this paper thereto. Having amended the Claim No 34, upon the suggestion of Mr Brown, and Claim No 29, I file them and the erroneous ones to you.

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Attached: CIPO, US-Ph1, US-Ph2, ABUSE, Chronological Table of Papers, E15, E16, E17a to d, E18, E19, E19A, P32P (pp2 and 5 of E25), Erroneous and amended Claims 29, 34, 5 PTO-2038 Forms

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Chronological Table of Papers

Appl. No. 08/860,182, filed 06/02/97

OAS is acronym of Office Action Summary

Paper	*US-Paper*	*mm/dd/yy*	*Document*	*from*
E0		06/02/97	Appl. No. 08/860,182	
E1		10/08/98	1st OAS	USPTO
E2		10/08/98	Objected terms in Claims of 1st OAS	USPTO
E3		12/15/98	Registered letter	Go to USPTO
E4	**P11**	02/10/99	2nd Final OAS	USPTO
E5		03/18/99	Fax regarding the objection to the opposed prior art	Go to Morrow
E6		03/31/99	Fax, however, I lost the fax-confirmation	Go to Morrow
E7		05/17/99	Registered letter (certified copy of DE 19543706.3)	Go to Morrow
E8		07/04/99	Registered submittal of the Description, Claims and Abstract	Go to Morrow
E9	**P19**	08/31/99	3rd OAS	USPTO
E10		09/10/99	Registered submittal of the amended Appl. (Description, Claims and Abstract)	Go to Morrow
E11		09/10/99	Amended Claims faxed to Morrow's Office	Go to Morrow
E12		09/24/99	Registered submittal of a new set of copies of all Figs, some of which are amended	Go to Morrow
E13		10/08/99	4th OAS confirming the approval on the amended Claims and Abstract (**E10, E11**)	USPTO
E14		10/17/99	Fax disclosing no objection of British Patent Office to the translation (**E21**)	Go to Morrow
E15		10/29/99	9 page-Fax showing how to amend the Description	Morrow
E16		11/04/99	Amended Description faxed to Morrow's Office	Go to Morrow
E17a		11/05/99	Fax concerning the revision of amended Description	Morrow to Go
E17b-d		11/05/99	Amended Description faxed to Morrow's Office	Go to Morrow;
E18		11/05/99	Registered submittal of the amended Appl. (Description, Claims and Abstract)	Go to Morrow
E19	**P22**	11/07/99	Amended Description faxed to Morrow's Office	Go to Morrow
E19A	**P22**	11/10/99	Fax concerning the revision of amended Description	Morrow to Go
E20	**P29**	04/10/2000	5th OAS responsive to the Enclosure **E18**	USPTO
E21		05/16/2000	Objections to the prosecution of the Appl	Go to USPTO
E22		07/26/2001	Goldberg's (PTC) reply to **E21**	USPTO
E23	**P30**	08/01/2001	Notice of Abandonment	Morrow to Go
E24		09/03/2001	Petition and reply to **E22** and **E23**	Go to USPTO
E25	**P32**	02/19/2002	Commissioner's reply to **E24**	USPTO

-Applicant timely filed a reply to the 8/31/99 final Office action,[5] and the Examiner mailed an advisory letter on October 8, 1999 ("10/8/99 Letter"), requiring that an amended reply sufficiently understandable for examination be filed on or by November 8, 1999;[6]
-Applicant's amended reply, though also timely filed,[7] was not responsive to the 10/8/99 Letter;[8]
-In lieu of holding the application abandoned as of November 9, 1999,[9] the Examiner gave Applicant further opportunity to advance the application to final action by issuing the 4/10/00 non-final Office action;[10]
-Rather than responding to this Office action, Applicant requested an investigation of the prosecution of this application in a June 2, 2000 letter, which was treated as a petition under 37 CFR 1.181 to review the *ex parte* action by the Examiner ("6/2/00 Petition");
-A decision on the 6/2/00 Petition was mailed on July 26, 2001 ("7/26/01 Decision"), concluding that this application had become abandoned for failure to timely submit a proper reply to the 4/10/00 non-final Office Action;[11]
-A Notice of Abandonment was mailed on August 1, 2001;
-The 9/10/01 Petition (letter) then followed.

pp. 2

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To be **grantable**, a petition under 37 CFR 1.137(a) **must** be accompanied by:

(1) the required reply, unless previously filed;[12]

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5 9/10/99: claims; 9/15/99: claims and substitute specification.

6 See Paper No. 22, page 2, 7th paragraph; and page 3, 3rd paragraph (The Examiner determined that the application was so replete with errors that more changes would be needed before another action on the merits could be issued).

7 10/17/99 and 11/7/99; see 7/26/01 Decision, page 3, 4th paragraph.

8 7/26/01 Decision, page 3, 4th paragraph.

9 37 CFR 1.135(b) ([A]ny amendment not responsive to the last [Office] action . . . will not operate to save the application from abandonment); 37 CFR 1.111 (The applicant's reply must appear throughout to be a *bona fide* attempt to advance the application to final action.); MPEP section 711.02(a) (Aug. 2001): "Abandonment may result . . . where applicant's reply is within the period for reply but is not fully responsive to the Office action."

pp. 5.

As for the 4/10/00 non-final Office Action, it contains the Examiner's response to Applicant's reply to the 10/8/99 Letter.[26] This 19-page document consists of a cover page with a mailing date that in turn determines the due date for the required reply; a 1-page Office Action Summary indicating, *inter alia*, disposition of the claims; and a 17-page Detailed Action which discusses the Examiner's review of Applicant's reply to the 10/8/99 Letter, as well as which claims are rejected, and which claims are objected to.[27] The 4/10/00 non-final Office Action concludes by stating that Applicant appears to be unfamiliar with the USPTO patent prosecuting procedure, and advising Applicant to retain the services of a patent attorney or agent, registered to practice before the USPTO, to prosecute this application on behalf of Applicant.[28]

Objected phrases used in Claims of Appl. 08/860;182 **"US-Ph1"**

Most of the objected phrases, found in the 1st submittal (E0), dated 06/02/97, objected in the 1st OAS (Office Action Summary) (E1), were amended in the successive submittals. In the 5th OAS (E20), dated 04/10/2000, the Examiner rejected the ***same objected phrases***, which are **not** listed in the Appls. (E16 to E19), the amended phrases of which and similar ones are found in the following US-Patent Docs:

1) 5,806,917 Townseed
2) 4,307,911 Pavlik Budd
3) 3,819,228 Cornacchia Fiat
4) 5,480,189 Davies Ford
5) 3,860,258 Feustel Ford
6) 5,306,067 Hull Ford
7) 5,527,080
8) 5,553,803 Mitzkus
9) 5,535,553 Staser GM
10)5,555,677 De Rees Chrysler

Objected phrases	*Amended phrases*	*Controversary*
supporting door frame	door frame	
compound assemblies	vehicular couple	
vehicle part	vehicular member	
post section	pillar	Jaguar's EP 0472284 A1 "post section"; US4,307,911 "post"
mutual post section	common pillar	
interlocking holes	receptables	
interlocking mating holes	mating receptables	
interlocking blocks	key	
interlocking mating blocks	mating extension member	
interlocking holes & interlocking blocks	keys & receptables	
interlocking assembly	interengaging assembly	
interlocking block	key	
interlocking hook	key (hook)	
window-guide element	window-guide channel	GM's US 5,535,553
U-shaped window-guide element	U-shaped window-guide channel	
U-shaped block	U-shaped extension member	
side rail	side rail	Ford's 5,480,189
reinforcing element	extension member	
reinforcing panel	plate	US 4,307,911 "panel"
reinforcing peripheral edges	flange	

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Objected phrases	*Amended phrases*	*Controversary*
top peripheral edge	reinforced flange	
bottom peripheral edge	reinforced flange	
post-section peripheral edge	flange	
auxiliary part (Claim 16)	retaining member	
auxiliary part (Claim 17)	housing	
outer door-counter-shaped auxiliary part	door-counter-shaped member	
latch mechanism	door lock	Ford's US 5,306,067 "latch mechanism"
striker	striker	Ford's US 5,306,067, EP 0659601 A1; both "striker"
washer	washer	Webster "washer"
screw	bolt	US 5,542,491 "screw"; Webster "screw, bolt"
sleeve	sleeve	

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Conclusion:

The Examiner Mr Jason Morrow, unfamiliar with the US-phrases, has failed to properly, prudently, diligently prosecute all the Appls. despite being reminded by phone of the approval (E13) and a careful prosecution.

PAULIC (BUDD) ABUSE

Problem case **E**: The door lock **248**, rigidly attached to vehicle door **8**, and the striker **298**, rigidly attached to pillar illustrated as B-pillar in **Fig.** 10A of U.S. Pat. No 4,307,911 representing the prior art, is provided with locking clearances in x-, y- and z-direction, thus ensuring the state of door locking and the normal operation of vehicle door. For the purpose of preserving the constant, small contour-clearance,

- the position „D_a" to „D_c" of each key **128a to 128c**, rigidly attached to vehicle door **8**, and the position „S_a" to „S_c" of mating receptacle **158a to 158c**, rigidly attached to lower stiff panel **156** of side rail **18**;
- the position „D_n" of key **148**, rigidly attached to vehicle door **8**, and the position „B_n" of mating receptacle **198**, rigidly attached to pillar,

must be provided with position-tolerances, **larger** than locking and assembly tolerances, in x-, y- and z-direction in order to avoid

1. interference with the locking operation of door lock **248** to striker **298** when closing vehicle door **8**;
2. expensive reworking at the assembly line;
3. customer complaints due to disturbing noises associated with the small distances of overlaying coils, representing the mating parts of interengaging assemblies, denoted as „$w \leq 0.2$ mm", shown in **Fig.** 11; and
4. high reject rate due to different references of coordinate system of vehicle door, finished by two to three suppliers and transported to assembly line, and of vehicle body **20**, finished at the assembly line. Huge costs are necessary to computerize design data of vehicle door and structure in data files, which must be evaluated by innovative programs to minimize those position-tolerances and reject rate, however, under the condition of the constant, small contour-clearance.

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Problem case **E1**: According to the prior art the taper-formed key **148** and the mating receptacle **198** should be in engagement or form-locking connection to ensure energy-transmission from one pillar to the other.

Because receptacle **198** and striker **298** are formed together in one piece, an adjustment of receptacle **198** changes the position of striker **298** to the door lock **248** as well as the clearance therebetween, which becomes too large or small. In order to properly latch and lock the vehicle door to vehicle structure the "interengaging" assembly is provided with large tolerance zones, thus violating the condition of the aforementioned feature.

When a vehicle is laterally crashed by a truck, the key **148** can disengage from mating receptacle **198** due to large clearance so the remaining energy totally deforms the vehicle door, whose intrusion can fatally injure the driver.

According to the prior art shown in **Fig.** 1A, contour tongues **16.1** should be in engagement with contour grooves **16.2** in order to integrate vehicle door **8, 8B** into side rail **18,** vehicle roof **17** and B-pillar in a side collision. Without "interengaging" assembly of the vehicle door and B-pillar, the normal operation of vehicle door would be possible if the outer door-contour "abcde" were square. Regarding the recent contour design, shown in **Figs.** 5 and 18, the line "ab" is generally curve-shaped, line "bc" of front door upwardly inclined ($\beta > 90^0$) or generally curve-shaped and line "bc" of rear door generally S-shaped, so contour grooves **16.2** would interfere with contour tongues **16.1** when closing the vehicle door. Furthermore, to sustain large impact energy it is necessary to reinforce the wide contour groove by an element which, unfortunately, can't be attached to the narrow upper member **8.17** of door frame.

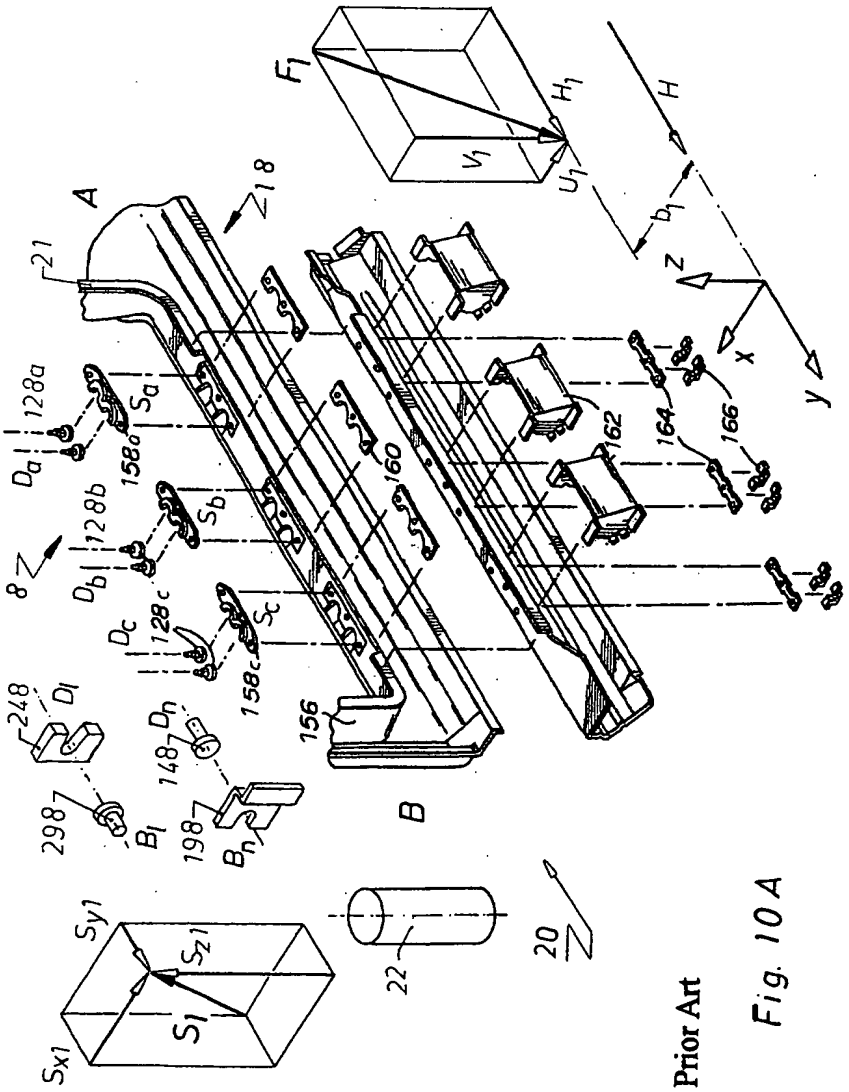
According to the U.S. Pat. No. 3,819,228 a bulky "engaging" bolt rigidly attached to a stiff inner panel of vehicle door **8** projects through a hole of a stiff element attached to side rail **18** when the door is in closed position. The problem of large tolerance zones remains unresolved. Moreover, the overall stylish impression spoilt by a bulky "engaging" bolt will, doubtless, not be beneficial to sales. When stepping in or out of the vehicle body while cleaning or repairing, the person can injure himself when stumbling over this bulky bolt. When closing the door the danger of damage to clothing and injury to passengers, particularly when it is dark, is apparent.

Problem case **E2**: Under the load of force „F_1", shown in **Fig.** 10A, in an approx. 30^0 inclined, offset front collision against another car the vehicle structure, totally deformed, is deflected, in great extent, in the opposite x-direction and in the y-direction thus resulting in disengagement of the catching hook **148**, rigidly attached to the impact beam **1, 1B** of driver-door, and the door lock **248** from the mating recess **198** and striker **298**, all of which are rigidly attached to the B-pillar, respectively, in association with the reduction of the distance between the A- and B- pillar from 860 mm to 490 mm in the y-direction and the

collapse of passenger protection. Later on, the remaining energy totally deforms the driver-door too. If the car rolls over, the driver would be ejected therefrom.
In a real-world side collision of another car into a tree, great energy totally deformed the vehicle side whose intrusion fatally injured both passengers. Obviously, the lateral force, deviating from the idealized force „S_{X1}", can never force catching hook **148** to penetrate into recess **198** in order to define an "interengaging" assembly. Both and other real-world accidents resulting in the collapse of vehicle structure linked to severe/fatal injuries verify the shortcomings of any patent valid only for survival chance under load of an idealized force „S_{X1}", shown in **Fig.** 10A.

Dr.-Ing. Giok Djien Go
Pfahlgrabenstr. 45
D-65510 Idstein
Germany

Fig.6 of Pavlik's 4,307,911



Prior Art

Fig. 10A

703 308 2177

[Click here and type return address and phone and fax numbers]

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E17 a

Fax

To:	Giok Djien Go	**From:**	Examiner Jason Morrow
Fax:	49 6126 8949	**Pages:**	1, cover sheet only
Phone:		**Date:**	11/05/99
Re:	Draft for 08/860,182	**CC:**	

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E 19A

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Pfahlgrabenstr. 45
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phone/fax +49 6126 8949

Registered

E 18

Mr Jason Morrow
Group Art Unit 3612
Customer Service Center, Initial Patent Examination Div.
US Department of Commerce
Patent and Trademark Office
Washington DC 20231

Patent Appl. No. 08/860,182

Dear Mr Morrow, 11/05/99

the faihure to fax you the remaining pages from 16 to 29 was, I presume, due to the shut-up of all Department fax machines at 5 pm. I left you a message in your phone box to forward the paper work by mail.
Please fax back your suggestion.

Thank you for your interest and help.

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Attached:
Description and claims with/without reference numeral in normal space, double space
Fig. 15

Einlieferungsbeleg Deutsche Post AG

Postvermerk

Deutsche Post AG 65185 Wiesbaden
04 4645 5022 20E E Int:
Tagesstempel anbringen, unterschreiben

Ident-Nummer einkleben.

8206110 3709 05.11.99 16:08

Unser Service-Telefon
0 18 05 / 29 06 90 (15 Sek. kosten 0,12 DM)
Montag – Freitag, 09.00 – 18.00 Uhr

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912 666 000 ☒ 1/98

Erroneous Claim 29 and 34 of Appl. No. 08/860,182, filed 09/03/2001

29. An increased stiffness of vehicle structure according to claim 4, wherein the interengaging assemblies of connecting vehicular couples, operating in many planes, are defined by

a plurality of keys rigidly arranged to the reinforced pillar, reinforced vehicle roof, reinforced side rail and reinforced flange of vehicle body, respectively; and

the mating receptacles arranged to the reinforcing members of vehicle doors, respectively.

34. An increased stiffness of vehicle structure [], [] characterised by use of metal, compound material, glass fibre reinforced material or non-metal material [] for material of [] a key, receptacle, [] window-guide channel, transverse girder, rod, plate and extension member.

29. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of vehicular couples, operating in many planes, are defined by
a plurality of keys rigidly arranged to the reinforced pillar, reinforced vehicle roof, reinforced side rail and reinforced flange of vehicle body, respectively; and
the mating receptacles arranged to the reinforcing members of vehicle doors, respectively.

30. An increased stiffness of vehicle structure according to claim **5**, wherein a member, whose contour is adapted to the door-contour, is rigidly attached to the window-guide channel and impact beams.

31. An increased stiffness of vehicle structure according to claim **30**, wherein the adjustable interengaging assemblies consist of
a plurality of keys bolted to the rear flange of the vehicle body reinforced by an element; and
mating holes arranged to the door-contour-shaped member.

32. An increased stiffness of vehicle structure according to claim **31**, wherein the adjustable interengaging assemblies of vehicle door & side rail, operating in three planes, are defined by
a plurality of keys rigidly arranged to the side rail and at least two keys, rigidly arranged to the reinforced flange of the vehicle body; and
the mating receptacles arranged to housings, the window-guide channels and door-contour-shaped member, respectively.

33. An increased stiffness of vehicle structure according to claim **5**, wherein the interengaging assemblies of series-connected vehicle doors & common pillar, operating in many planes, are defined by
a plurality of keys rigidly arranged to the extension members of the common pillar and a plurality of keys, rigidly arranged to the reinforcing members of series-connected vehicle doors, respectively; and
the mating receptacles arranged to the reinforcing members of series-connected vehicle doors and the reinforced common pillar, respectively.

34. An increased stiffness of vehicle structure according to claim **1**, wherein metal, compound material, glass fibre reinforced material or non-metal material is suited for material of the key, receptacle or window-guide channel.

29. An increased stiffness of vehicle structure according to claim **4**, wherein the interengaging assemblies of vehicular couples, operating in many planes, are defined by
a plurality of keys **(15.1 to 15.7, 30, 32, 35, 37)** rigidly arranged to the reinforced pillar, reinforced vehicle roof, reinforced side rail and reinforced flange of vehicle body, respectively; and
the mating receptacles arranged to the reinforcing members of vehicle doors, respectively.

30. An increased stiffness of vehicle structure according to claim **5**, wherein a member **(6.5C)**, whose contour is adapted to the door-contour, is rigidly attached to the window-guide channel **(6B)** and impact beams **(1B, 7B)**.

31. An increased stiffness of vehicle structure according to claim **30**, wherein the adjustable interengaging assemblies consist of
a plurality of keys **(37)** bolted to the rear flange **(21)** of the vehicle body **(20)** reinforced by an element **(21.4B, 21.6B, 21.5B)**; and
mating holes arranged to the door-contour-shaped member **(6.5C)**.

32. An increased stiffness of vehicle structure according to claim **31**, wherein the adjustable interengaging assemblies of vehicle door **(8, 8B)** & side rail **(18)**, operating in three planes, are defined by
a plurality of keys **(15.4a)** rigidly arranged to the side rail **(18)** and at least two keys **(30, 32, 35, 37)**, rigidly arranged to the reinforced flange **(21)** of the vehicle body **(20)**; and
the mating receptacles arranged to housings **(6.5, 6.5B)**, the window-guide channels **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)** and door-contour-shaped member **(6.5C)**, respectively.

33. An increased stiffness of vehicle structure according to claim **5**, wherein the interengaging assemblies of series-connected vehicle doors & common pillar, operating in many planes, are defined by
a plurality of keys **(15.3, 15.3a, 15.5, 15.5a)** rigidly arranged to the extension members **(17.3, 18.3, 23)** of the common pillar and a plurality of keys **(33, 34, 36)**, rigidly arranged to the reinforcing members of series-connected vehicle doors, respectively; and
the mating receptacles arranged to the reinforcing members of series-connected vehicle doors and the reinforced common pillar, respectively.

34. An increased stiffness of vehicle structure according to claim **1**, wherein metal, compound material, glass fibre reinforced material or non-metal material is suited for material of the key, receptacle or window-guide channel.

* * * KOMMU ATIONSERGEBNISBERICHT (4.NOV.15.. 23:15) * * *

TTI GO TECHNOLOGIES

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689	SPEICHER SENDEN		MORROW USPTO	OK	S. 3/3

1-3

E16

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

Dear Mr Morrow, 11/04/99

I amended the error "*minimum tolerances*" in Claim 3 pp. 18/col. 22 to "*permissible tolerances*" and added the symbol „$-x_n$", „$-y_n$" and „y_p" in Fig. 15 for the sake of better understanding the description. There is a BIG DIFFERENCE between the US-Description of the Preferred Embodiments and the non-US Description. Frankly to say, I was not able to understand the reason for narration till receiving your fax, wherein the explanation is found. I wish to thank you therefor and for the coming amendments/suggestions.

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INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

CROSS REFERENCE TO RELATED APPLICATIONS

* * * KOMMUNIKATIONSERGEBNISBERICHT (4.NOV. 99 23:17) * * *

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4-6

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

E6 Clamping assemblies or adjustable interengaging assemblies to resolve problem case E.

Problem case A: In order to idealize an impact force $2F_1$, shown in Fig. 10A, imposed on a vehicle structure the following assumptions must be specified:

- let the vehicle structure be idealized by two symmetric vehicle halves subjected to an front impact force 2F along the centre line.

Load case I in z-y plane in Fig. 5: The moment $M_x = H*h$ about the x-axis is replaced by a pair of forces $H_A = (H*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: $-V$, $(H_A + V_A)$ and $-(H_A + V_B)$. Under load of these forces the vehicle side, comprising all post sections, series-connected doors 8, 8R reinforced by impact elements and

"engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

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696	SPEICHER SENDEN		MORROW USPTO	OK	S. 3/3

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

transmitted through both head rests, integrated into the respective seatbacks, to the vehicle floor, thereby reducing the AIS of both passengers. AIS is an international acronym of Abbreviated Injury Severity ranging from 0 (no injury) to 6 (fatality).

Responsive to problem case **E**, adjustable and/or latching mechanisms are provided for interengaging assemblies, whose adjustable and/or latchable keys are bolted to the B- or C-post section, facing the termini of both reinforcing beams **1, 7** or **1B, 7B**, and whose mating receptacles are arranged thereto. Both plates **5.1, 5.2** of each hinge of vehicle door are provided with a rivet serving as key and an oblong mating hole. Owing to this feature load cases **I** to **IV** are resolved, but load case **V** and problem cases **E3** to **E5** remain unresolved.

Evidently, due to load cases **I** to **V** and all problem cases **B, E, E1** to **E5** "interengaging" assemblies of the remaining prior art are unsuitable for the purpose of energy-transmission and distribution by means of the integration of vehicle doors **8**

* * * KOMMU ATIONSERGEBNISBERICHT (5.NOV.19 , 19:12) * * *

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705	SPEICHER SENDEN		MORROW USPTO	OK	S. 4/4

E 176-d

FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

Dear Mr Morrow, 11/04/99

I amended the error "*minimum tolerances*" in Claim 3 pp. 18/col. 22 to "*permissible tolerances*" and added the symbol „$-x_n$", „$-y_n$" and „y_p" in Fig. 15 for the sake of better understanding the description. There is a BIG DIFFERENCE between the US-Description of the Preferred Embodiments and the non-US Description. Frankly to say, I was not able to understand the reason for narration till receiving your fax, wherein the explanation is found. I wish to thank you therefor and for the coming amendments/suggestions.

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INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

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FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

Load case **IV** in x-y plane in **Fig.** 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.

Load case **V** in z-x plane in **Fig.** 10: Under load of side impact energy S at impact angle γ or in the real side collision against a tree or highway column 22, shown in **Fig.** 10A, 13, the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.

The total stress consists of the stresses in load cases **IV** and **V**.

Problem case **B**: The majority of the prior art is governed by the following assumptions:

- let clearances between mating parts of an interengaging assembly be neglected and
- let the load cases **IV** and **V** be idealized to a lateral energy S_x, shown in **Fig.** 9, or

"engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

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FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

"engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

- to increase the vehicular stiffness

in the event of any collision and/or rollover. These interengaging assembly are arranged to the corresponding vehicular couples (vehicle member & mating vehicle member).

This principle and other objects of the present invention are accomplished by the following features (proposals):

- minimum tolerances by installing and adjusting the engaging keys from outside to tightly mate the receptacles thereby ensuring the connection of the doors with all vehicle members of vehicle body 20 such as post sections, vehicle roof 17, flange 21, a pair of side rails 18, fastened to vehicle floor, in any collision and/or on rollover;
- interengaging assemblies with adjusting mechanisms such as holes & keys 15.1 to

DAT.	MODUS	OPTION	ADRESSE (GRUPPE)	ERGEBNIS	SEITE
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FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG

- intrusion of vehicle roof 17 into the vehicle body and of upper door frame 8.17, thus squashing the passengers and
- buckling of the upper portion of the A-post section, total deformation of upper door frame 8.17, buckling of vehicle roof 17 and buckling of side rails 18,

shown in Fig. 8.

In order to avoid the above-mentioned state a number of holes or keys 30 to 37 is arranged to the flange 21 *above*, *below* of the impact beams 1, 7 and *therebetween*. When the *non-adjustable* rivets *5.6* of the door hinges in x-z operating plane are replaced by a number of interengaging assemblies 15.1, 15.2a, 15.4, 30, 31 in numerous operating planes, the total stress of the vehicular couples: A-post section & vehicle door along the z-axis is lower owing to stress distribution, thereby preventing, to a certain extent, the A-post section and vehicle door from total deformation and gap „o", shown in Fig. 8.

6.1, 6.2, 6.1B, 6.2B, shown in Figs. 1 and 3, are made from U-shaped thin panel. As *reinforcing elements* the window-guide elements are of higher-grade tensile strength 6.1a, 6.2a, 6.1aB, 6.2aB to:

- reinforce the U-shaped window-guides of metal sheets,
- receive parts such as hooks, keys and/or holes and
- receive elements 6.5, 6.5B, 6.6a, 6, 6b, 6.7a, 6.7b, 6.8, 6.9 (not drawn) as structural element with higher-grade tensile strength.

The elements 6.8, 6.9 ref. to Fig. 14 are fixedly attached to the front faces of both impact beams 1B, 7B and window-guide element 6B, the elements 6.6b, 6.7b to window-guide element 6 and impact beam 7 and the elements 6.6a, 6.7a to window-guide element 6 and between both impact beams 1, 7.

Both window-guide elements are replaceable by an U-shaped stiff window-guide element 6, 6B shown in Figs. 2, 2A, 14 to 17. Less stiff elements 6.3, 6.3B are

costs as well as making tight engagement impossible resulting in door detachment in accident. To resolve these problems straight (non-curved, non-inclined or non-tapered) engaging surfaces are proposed for key and receptacle. The purpose of assembling and adjusting any key, shown in Figs. 3, 3A, 4 and 4A, from outside of the vehicle body 20 is to substantially cut labour time and costs. Costs can be enormously lowered by using mechanical connecting parts, particularly standard parts like washer (ref. to DIN 125), hexagon socket head screw (ref. to DIN 912) etc. With the exception of 15.4a each key 15.1 to 15.5a, 15.7, 15.8, 30 to 37 comprises a screw 15.14, a sleeve 15.11, a number of washers built into one spacer 15.12 and a washer with a large exterior diameter 15.13, illustrated in Figs. 3A, 14 to 18. In order to ensure the engagement of key with mating hole a protrusion „x_m" and circumferential clearance „c_c", explained in the next section, must be preserved by:

- correcting the length of spacer „l" by removing or adding washers and/or

* * * KOMMU ATIONSERGEBNISBERICHT (5.NOV.19.. 19:47) * * *

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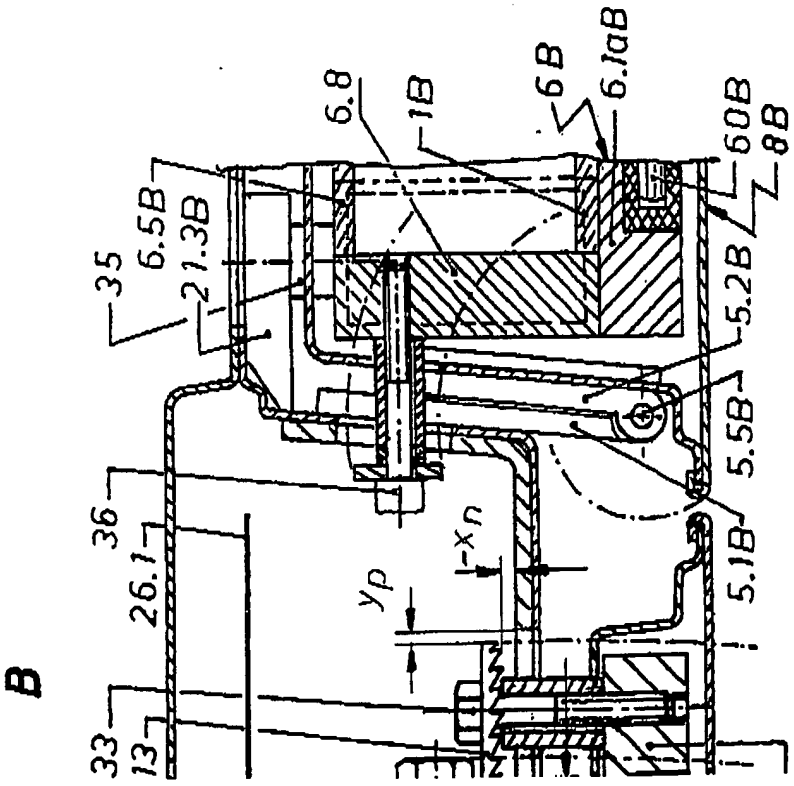
FEHLERURSACHE
E-1) ÜBERTRAGUNGSFEHLER
E-2) BESETZT
E-3) KEINE ANTWORT
E-4) KEINE FAX-VERBINDUNG



Shaker (part)

E19

Mr Jason Morrow
Group Art Unit 3612

Patent Appl. No. 08/860,182

Dear Mr Morrow, 11/07/99

Unfortunately, I discovered some errors.

Amendment of pp. 25/col. 6:

The Technical Mechanics Method

Amendment of pp. 29/col. 1 to 13:

Large total stress of the load cases e.g. **I to III** results in total deformation (buckling) of the post sections, side rail, vehicle roof and/or doors because stress of vehicle body and doors in a real accident can never be predetermined in the research and crash tests, three of which are mentioned in the problem case **E4**, due to the collision type, the boundary conditions and properties of two masses colliding against each other. Four front collision types are shown in **Fig. 13**. In a real accident a front, side and/or rear collision can end up in a pile-up or on a rollover, thus increasing the number of collision types and making a FEM calculation impossible. To resolve such indeterminate stress the vehicular couples comprising front post section / door **8, 8B**, rear post

Mr Jason Morrow
Group Art Unit 3612

Patent Appl. No. 08/860,182

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Please fax back your suggestion.

Thank you for your interest and help.

kind regards

Go

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I amended the error "*minimum tolerances*" in Claim 3 pp. 18/col. 22 to "*permissible tolerances*" and added the symbol „-x_n", „-y_n" and „y_p" in Fig. 15 for the sake of better understanding the description. There is a BIG DIFFERENCE between the US-Description of the Preferred Embodiments and the non-US Description. Frankly to say, I was not able to understand the reason for narration till receiving your fax, wherein the explanation is found. I wish to thank you therefor and for the coming amendments/suggestions.
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kind regards.

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INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

CROSS REFERENCE TO RELATED APPLICATIONS

I admit it was wrong

This is a continuation-in-part application of co-pending international application number PCT/DE 96/02120 (WO 97/18984, EP 0869878 B1) filed Nov. 7, 1996 and claiming the priority of DE 195 43 706 A1 filed Nov. 17, 1995. ~~is revised and refiled~~.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to vehicle doors and, more particularly, to interengaging assemblies which structurally integrate all vehicle doors, when closed, with the vehicle roof, both side rails (sill portions) arranged along the vehicle floor, all post sections (pillar portions) and the flanges of door apertures of a vehicle body thereby distributing energy to all those vehicle members, lowering stress thereof,

preventing passenger ejection and enhancing survival chance in the event of any collision (front, side and/or rear collision) or rollover.

2. Discussion of the Prior Art:

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"*series-connected doors*"	doors of one vehicle side are series-connected
"*girder*"	panel, shell, beam etc. according to FEM and Technical Mechanics
"*window-guide elements*" of vehicle doors	window-guides **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6:2aB**
"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body
"*mating parts of interengaging assembly*"	mating parts of an interengaging assembly such as key & receptacle, hook & recess, hole & key or hook & rod
"*engaging hole*"	aperture, slot, oblong hole
"*vehicular couple*"	two mating vehicle members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & flange (transition region) of vehicle body, vehicle door & post section/s, vehicle door & vehicle door in engagement

in the event of any collision and/or rollover

It is known in the prior art to provide interengaging assemblies to engage and/or clamp the vehicle door with the mating vehicle members, when the vehicle door is in closed position, thus distributing energy, lowering stress whilst enhancing survival chance only in the event of either mid-front collision or side collision of type U2, one of four types shown in **Fig.** 13. However, all these conventional configurations do not take into account the failure of passenger protection due to the following problem cases in conjunction with disengagement of the mating parts of interengaging assemblies from each other in the event of all types of real collision (any real collision) or real rollover:

A Load cases **I** to **V** according to Technical Mechanics/FEM in real front, side and rear collision;

B Wrong assumption of the prior art for the purpose of idealizing a general side energy S or S_1 to a single energy S_x or S_{x1};

C Analogy between the state of non-contact and disengagement;

D Constant, small contour-clearance and assembly tolerance zones;

E Large clearances of interengaging assemblies;

E1 The first inventions of interengaging assemblies, huge production costs and fatal injury in real collision due to large clearances;

E2 Large deformation of vehicle structure or door **8. 8B** in real collision;

E3 Large deformation of side rail **18** in real collision;

E4 Large deformation of upper door frame **8.17** and vehicle roof **17** in real collision;

E5 Intrusion of vehicle roof **17** in vehicle body **20** on real rollovers; and

E6 Clamping assemblies or adjustable interengaging assemblies to resolve problem case **E**.

Problem case **A**: In order to idealize an impact force $2F_1$, shown in **Fig. 10A**, imposed on a vehicle structure the following assumptions must be specified:

- let the vehicle structure be idealized by two symmetric vehicle halves subjected to an front impact force 2F along the centre line.

Load case **I** in z-y plane in **Fig. 5**: The moment $M_x = H^*h$ about the x-axis is replaced by a pair of forces $H_A = (H^*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V^*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: -V, $(H_A + V_A)$ and $-(H_A + V_B)$. Under load of these forces the vehicle side, comprising all post sections, series-connected doors **8, 8B** reinforced by impact elements and interengaging assemblies of those doors and post sections, is subjected to the bending moment along the y-axis.

Load case **II** in z-x plane in **Fig. 6**: The force V exerts bending moment M_{zx} along the x-axis and rotating moment $M_y = V^*b$ about the y-axis acts as torsional moment along the vehicle side.

Load case **III** in x-y plane in **Fig. 7**: The A-post section is under load of rotating moment $M_{xy} = -H^*b$. The vehicle side is subjected to bending moment M_{xy} along the y-axis and buckling force H.

Subjected to the total stress of bending moments M_{zx}, M_{xy}, M_{zy}, buckling force H and torsional moments M_z, M_y in the load cases **I to III**, the vehicle side, shown in **Fig. 8**, is deformed in real front collision.

By reversibly arranging the series-connected doors **8, 8B** the same load cases are obtained for real rear collision.

Load case **IV** in x-y plane in **Fig.** 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.

Load case **V** in z-x plane in **Fig.** 10: Under load of side impact energy S at impact angle γ or in the real side collision against a tree or highway column **22**, shown in **Fig.** 10A, 13, the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.

The total stress consists of the stresses in load cases **IV** and **V**.

Problem case **B**: The majority of the prior art is governed by the following assumptions:

- let clearances between mating parts of an interengaging assembly be neglected and
- let the load cases **IV** and **V** be idealized to a lateral energy S_x, shown in **Fig.** 9, or S_{x1}, shown in **Fig.** 10A, imposing on the *centre* of vehicle door, illustrated as collision type U1, shown in **Fig.** 13, despite four collision types U1 to U4 and the collision type U2 having the highest percentage of severe and fatal injuries. Nevertheless, car manufacturers and suppliers world-wide have adopted this idealized S_x or S_{x1} in inventions e.g. U.S. Pat. No. 4,307,911, U.S. Pat. No. 5,806,917, U.S. Pat. No. 5,518,290, whose shortcomings are mentioned in the following problem case **E2**.

Problem case **C**: Ref. to **Figs.** 11, 12 both end coils of compression-coil spring **19** are guided by two spring seats **19.1**. Their utmost outer nodes KN_1 and KN_{End} (not drawn) rest against both stops **19.3**, where i represents the number of coils. To survey the rolling behaviour of end coil **19** on the lower spring seat **19.1** the end coil is idealized in elements by supporting springs in reference to the nodes and by the threshold value of the distance in the "state of rolling" $s < 0.1$ mm. **Fig.** 12 illustrates

the rolling behaviour in regard to the FEM data and test results marked with M in dependence on F_z = -790, -1000 and -3000 N:

- According to test results KN_2 to KN_5 roll on the spring seat at F_z = -790 N, but in the state of non-contact at F_z = -1000 and -3000 N.
- According to FEM data the nodes in the following states are in dependence on F_z:

F_z	State of contact	State of rolling
-100	KN_1, KN_{15}, KN_{17}	KN_1 to KN_3, KN_{10} to KN_{18}
-250	KN_1, KN_{19}, KN_{20}	KN_1, KN_{15} to KN_{23}
-1415	KN_1, KN_{17}, KN_{19}, KN_{20}, KN_{30}, KN_{31}, KN_{33}, KN_{34}	KN_1, KN_{15} to KN_{35}

The state of contact (engagement) of mating parts of interengaging assemblies, idealized by nodes of the rolling end coils and mating elements of the spring, can be transformed into the state of disengagement, when the force increases.

Problem case **D**: Recently in automotive industry, great efforts have been made to achieve (finish) a constant (uniform), small contour clearance between the outer door-contour "abcde" of vehicle door **8, 8B** and the door aperture of vehicle body **20**, shown in **Fig. 5**, in order to minimize flow noise and, particularly, to achieve sales success in co-operation with an overall impression of attractive design. In the state of assembly the contour clearance e.g. of AUDI ® vehicles is only 2.5 mm and of VW Passat ® 3.5 mm.

In order to meet the above-mentioned goal and to avoid rework or reject rate large assembly tolerances between the outer door-contour and the door aperture (opening) of vehicle body **20** must be designed.

Problem case **E**: The door lock **248**, rigidly attached to vehicle door **8**, and the striker **298**, rigidly attached to post section illustrated as B-post section in **Fig. 10A** of U.S.

Pat. No 4,307,911 representing the prior art, is provided with locking clearances in x-, y- and z-direction, thus ensuring the state of door locking and the normal operation of vehicle door. For the purpose of preserving the constant, small contour-clearance,

- the position D_a to D_c of each key **128a to 128c**, rigidly attached to vehicle door **8**, and the position S_a to S_c of mating receptacle **158a to 158c**, rigidly attached to lower stiff panel **156** of side rail **18**;
- the position D_n of key **148**, rigidly attached to vehicle door **8**, and the position B_n of mating receptacle **198**, rigidly attached to post section,

must be provided with position-tolerances, **larger** than locking and assembly tolerances, in x-, y- and z-direction in order to avoid

1. interference with the locking operation of door lock **248** to striker **298** when closing vehicle door **8**;
2. expensive reworking at the assembly line;
3. customer complaints due to disturbing noises associated with the small distances of overlaying coils, representing the mating parts of interengaging assemblies, denoted as $w \leq 0.2$ mm, shown in **Fig. 11**; and
4. high reject rate due to different references of coordinate system of vehicle door, finished by two to three suppliers and transported to assembly line, and of vehicle body **20**, finished at the assembly line. Huge costs are necessary to computerize design data of vehicle door and structure in data files, which must be evaluated by innovative programs to minimize those position-tolerances and reject rate, however, under the condition of the constant, small contour-clearance.

Problem case **E1**: According to the prior art the taper-formed key **148** and the mating receptacle **198** should be in engagement or form-locking connection to ensure energy-transmission from one post section to the other.

Because receptacle 198 and striker 298 are formed together in one piece, an adjustment of receptacle 198 changes the position of striker 298 to the door lock 248 as well as the clearance therebetween, which becomes too large or small. In order to properly latch and lock the vehicle door to vehicle structure the "interengaging" assembly is provided with large tolerance zones, thus violating the condition of the aforementioned feature.

When a vehicle is laterally crashed by a truck, the key 148 can disengage from mating receptacle 198 due to large clearance so the remaining energy totally deforms the vehicle door, whose intrusion can fatally injure the driver.

According to the prior art shown in Fig. 1A, contour tongues 16.1 should be in engagement with contour grooves 16.2 in order to integrate vehicle door 8, 8B into side rail 18, vehicle roof 17 and B-post section in side collision. Without "interengaging" assembly of the vehicle door and B-post section, the normal operation of vehicle door would be possible if the outer door-contour "abcde" were square.

Regarding the recent contour design, shown in Figs. 5 and 18, the line "ab" is generally curve-shaped, line "bc" of front door upwardly inclined ($\beta > 90^0$) or generally curve-shaped and line "bc" of rear door generally S-shaped, so contour grooves 16.2 would interfere with contour tongues 16.1 when closing the vehicle door. Furthermore, to sustain large impact energy it is necessary to reinforce the wide contour groove by an element which, unfortunately, can't be attached to the narrow upper region of door frame 8.17.

According to the U.S. Pat. No. 3,819,228 a bulky "engaging" bolt rigidly attached to a stiff inner panel of vehicle door 8 projects through a hole of a stiff element attached to side rail 18 when the door is in closed position. The problem of large tolerance zones remains unresolved. Moreover, the overall stylish impression spoilt by a bulky "engaging" bolt will, doubtless, not be beneficial to sales. When stepping in or

out of the vehicle body while cleaning or repairing, the person can injure himself when stumbling over this bulky bolt. When closing the door the danger of damage to clothing and injury to passengers, particularly when it is dark, is apparent.

Problem case **E2**: Under the load of force F_1, shown in **Fig.** 10A, in an approx. 30^0 inclined, offset front collision against another car the vehicle structure, totally deformed, is deflected, in great extent, in the opposite x-direction and in the y-direction thus resulting in disengagement of the catching hook **148**, rigidly attached to the impact beam **1, 1B** of driver-door, and the door lock **248** from the mating recess **198** and striker **298**, all of which are rigidly attached to the B-post section, respectively, in association with the reduction of the distance between the A- and B-post section from 860 mm to 490 mm in the y-direction and the collapse of passenger protection. Later on, the remaining energy totally deforms the driver-door too. If the car rolls over, the driver would be ejected thereout.

In a real side collision of another car into a tree, great energy totally deformed the vehicle side whose intrusion fatally injured both passengers. Obviously, the lateral force, deviating from the idealized force S_{X1}, could not force catching hook **148** to penetrate into recess **198** in order to define an "interengaging" assembly.

Both real accidents resulting in severe/fatal injuries verify the shortcomings of any patent valid only for survival chance under load of an idealized force S_{X1}, denoted by arrow A in Fig. 1 of U.S. Pat. No. 5,518,290. Taken as given, the mid region of door is secured to the B-post section by the "interengaging" assembly in an "idealized" accident, the upper, lower door frame **8.17, 8.18**, the vehicle roof **17** and side rail **18** are overstressed due to lack of interengaging assemblies. Moreover, problem cases **E3** to **E6** remain unresolved.

As exemplified by U.S. Pat. No. 4,676,524, a pair of vertically supporting window-columns, rigidly mounted in both vehicle doors **8** of a convertible car is in abutting,

"engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance on rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of the key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement,

thereby totally deforming the cowl and pair of window-columns.

The stiffness of an open roof of a convertible car, merely supported by a pair of post sections in force-locking or free connection with one pair of small-size window-columns, is

- very low, thereby resulting in fatality on a real rollover thereof;
- lower than that of a rotatable, stiff rollover bar;
- far lower than that of the closed roof **17** supported by two pairs of post sections and
- substantially far lower than that of the closed roof **17** strongly supported by three pairs of reinforced post sections.

Problem case **E3**: Due to great energy in a real side collision against column **22** of a central barrier, shown in **Fig.** 10A, 13, on a highway

- large deformation of side rail 18 and rear section of a vehicle, opposite to x-direction, caused the disengagement of the driver's less deformed vehicle door 8 from vehicle structure and later on
- the vehicle rolled over three times across the highway and down-hill, thus totally deforming vehicle structure, doors 8, tailgate-door 8T, out of which both rear passengers were hurled, and, alternately, opening and closing both vehicle doors 8, out of which both front passengers were hurled out.

Grass 70 clamped between each post section and each vehicle door 8, shown in Fig. 8, was an evidence for the alternate opening and closing of both vehicle doors 8 during the rollovers.

In a side collision of a car into a tree great energy totally deformed vehicle door 8 whose intrusion severely/fatally injured the passengers.

In a collision of another car into a hill great energy totally deformed the right side rail 18 thus resulting in the disengagement of the door lock 248 and, if provided, interengaging assemblies too and later on totally deforming vehicle structure during rollover. The driver was hurled out of this car.

Problem case E4: In front collision or crash test impact energy deforms, in general, upper door frame/s 8.17 outwards and vehicle roof 17 upwards, thereby creating a gap „o", shown in Fig. 8, and preventing front vehicle door/s 8, 8B and/or vehicle roof 17 from transmitting energy to vehicle body 20.

Three different states of deformation are reproduced in three crash tests, conducted by ADAC, of the German vehicles of the same type 40 % offset crashed at the same speed of 50 km/h against

- a very stiff barrier,
- a deformable barrier and

– another vehicle of the same type

because the uniform load, deformable property of two colliding masses, impact condition etc. are different. The gap „o " in three different sizes, shown in Fig. 8, verifies the above-mentioned thesis of non-transmission of energy.

In side collision impact energy deforms, in general, upper door frame/s **8.17** inwards thereby inflicting injuries on head.

Problem case **E5**: During the rollover of a car, impact energy totally deformed vehicle roof **17** whose intrusion severely or fatally injured both front passengers, whose heads were, definitely, crushed by falsely deployed airbags, and the remaining energy totally deformed vehicle body **20** and doors **8, 8B, 8T, 8x.**

Problem case **E6**: Responsive to problem case **E**, a clamping assembly illustrated in Fig. 1B comprises

– a stiff hook of stiff ledge **25.2** rigidly mounted to lower door frame **8.18** and

– a thin mating panel of a stiff plate **25.1,** rigidly attached along sill rail **18**, serving as a site of predetermined fracture.

In excess of predetermined value in real side accident, the mating parts **25.1, 25.2** of interengaging assemblies are in the state of clamping to ensure the permanent engagement of lower door frame **8.18** with sill rail **18** in order to resolve the problem of passenger ejection. Load cases **I to III, V** and problem cases **E2 to E5** remain unresolved. Furthermore, there is no space to house both mating parts **25.1, 25.2** in vehicle roof **17** and upper door frame **8.17** subjected to lateral load F_o in real accident. The lack of interengaging assemblies became obvious on the rollover of a sport car, which plunged seven meter downwards and crashed with vehicle roof **17** at a lower level of an underpass in Wiesbaden City thus totally deforming vehicle roof **17**, body **20** and both upper door frames **8.17** during rollover, where the remaining energy was

transmitted through both head rests, integrated into the respective seatbacks, to the vehicle floor, thereby reducing the AIS of both passengers. AIS is an international acronym of Abbreviated Injury Severity ranging from 0 (no injury) to 6 (fatality).

Responsive to problem case **E**, adjustable and/or latching mechanisms are provided for interengaging assemblies, whose adjustable and/or latchable keys are bolted to the B- or C-post section, facing the termini of both reinforcing beams **1, 7** or **1B, 7B**, and whose mating receptacles are arranged thereto. Both plates **5.1, 5.2** of each hinge of vehicle door are provided with a rivet serving as key and an oblong mating hole. Owing to this feature load cases **I to IV** are resolved, but load case **V** and problem cases **E3 to E5** remain unresolved.

Evidently, due to load cases **I to V** and all problem cases **B, E, E1 to E5** "interengaging" assemblies of the remaining prior art are unsuitable for the purpose of energy-transmission and distribution by means of the integration of vehicle doors **8, 8B, 8T** into the vehicle body **20**, in conjunction with five tolerance zones proposed by U.S. Pat. No. 5,297,841, U.S. Pat. No. 4,307,911 and eight tolerance zones proposed by U.S. Pat. No. 5,806,917.

SUMMARY OF THE INVENTION

Accordingly, the principle object of the present invention is to overcome the deficiencies of the prior art by providing engagement for interengaging assembly having large clearances, which are necessary in car manufacturing and door assembly, in order

- to protect passengers against ejection from the vehicle body and/or intrusion of vehicle member and

– to increase the vehicular stiffness

in the event of any collision and/or rollover. These interengaging assembly are arranged to the corresponding vehicular couples (vehicle member & mating vehicle member).

This principle and other objects of the present invention are accomplished by the following features (proposals):

– minimum tolerances by installing and adjusting the engaging keys from outside to tightly mate the receptacles thereby ensuring the connection of the doors with all vehicle members of vehicle body **20** such as post sections, vehicle roof **17**, flange **21**, a pair of side rails **18**, fastened to vehicle floor, in any collision and/or on rollover;

– interengaging assemblies with adjusting mechanisms such as holes & keys **15.1 to 15.5a, 15.7, 15.8**, hooks **15.6** & reinforcing rod **17.1d** and holes & keys **30 to 37**, shown in **Fig.** 1, 3, 3A, 4, 4A and 14 to 18;

– window-guide elements to accommodate the engaging parts;

– space-saving, inexpensive design for engaging parts;

– arrangement of interengaging assemblies of a vehicular couple in at least two operating planes thus making the strict restriction of minimum tolerances less significant;

– arrangement of an U-shaped extension member having keys in the common post section of the series-connected vehicle doors, whose holes mate with the keys to ensure the engagement owing to constrained deformation thereof.

Despite the failure of the prior art in the event of real side collision any modification and extra design for survival chance in real collision and/or on rollover will generate costs, R&D expenses and weight due to the use of other inventions.

Summary of the advantages of the present invention:

A) saving labour-time by installing and adjusting engaging parts from outside the vehicle body.

B) low reject rate.

C) space-saving, inexpensive design.

D) dissimilar operating planes or at least two operating planes for each vehicular couple to ensure the engagement of its interengaging assemblies in association with energy absorption due to load cases in three different planes. **Figs.** 14 to 18 illustrate *a single vehicular couple*: window-guide element & B-post section with the interengaging assemblies: keys **34** & holes in z-x plane acting as the first operating plane, however, interengaging assemblies: keys **32, 33** & holes in z-y plane acting as the second operating plane. The specification is changed from the minimum tolerances of "narrow" to permissible tolerances of "far less narrow", thus cutting costs and time associated with less adjustment work to reduce large clearances thereto. This feature of dissimilar operating planes is applicable too for both interengaging assemblies: holes & **15.1, 15.2a** and **15.2, 15.3** and **15.4a, 15.5** etc., shown in **Fig.** 3. A row of the same keys is operative in dissimilar operating planes by arranging a number of the same keys **15.1** to the generally inclined A-post section or of keys **33** to the generally inclined B-post section. In reference to the global xyz coordinate system the key **15.2a** & hole is operative in an inclined plane.

Because the hinge bolts of the front and rear doors have an operating direction in z-axis the arrangement of interengaging assemblies: holes & keys **31, 36** to one

operating plane is sufficient. However, any additional arrangement of holes & keys **30, 35** improves the engagement of vehicle mating parts and substantially decreases severe/fatal injuries in any real collision.

E) minimizing the R&D work by reducing FEM calculations, crash tests and by saving material due to the arrangement of interengaging assembly in different operating planes.

F) passenger protection for all collisions by a **single** construction, manufacturing, testing expenditure, assembly and material supply.

G) exploitation of the flange **21, 21T, 21h, 21x** of vehicle body **20** provided with sound-proofing material **21.10**, shown in **Figs.** 1, 17, 18, due to the sites to accommodate keys and the continuous stress curve. The enlargement of the flange to a limited extent neither impairs the overall stylish impression nor obstructs the passenger from ingress into or engress from the passenger compartment. Those edges (regions) of all post sections are defined by the dotted lines "a1", "b1", "b2" and "c1".

H) overall stylish impression. As substitutes of the bulky bolt ref. to U.S. Pat. No 3,819,228 small-size parts can be distributed in inconspicuous manner along the window-guide elements as well as flange, thus substantially ensuring the engagement of vehicular couple whilst lowering stress. Due to this feature it is possible to arrange the following keys:

- **30, 32, 35, 37** to the respective flange **21** of vehicle body **20**. In contrary to U.S. Pat. No. 3,819,228, this feature won't endanger passenger when stepping in or out, furthermore, more useful for passenger protection in side collision, particularly, according to collision types U1 and U2, shown in **Fig.** 13, as well as in front collision.

- **15.2a, 15.2, 15.7** e.g. with screws M4 to the narrow window-guide element **6.3, 6.3B** of upper door frame **8.17** to resolve the problem of the large, stiff contour groove of the prior art.
- **33, 34, 36** to the respective window-guide elements **6, 6B** and elements **6.7, 6.8** in engagement with the reinforced B-post section in two to three operating planes without obstructing the operation of the seat belt **26.1**, shown in **Fig. 15**. The fact, that no contact is made during the opening operation of series-connected vehicle doors, is demonstrated by the trajectories of both outer points of the washer and of the door edges drawn with dotted lines.
- **31** to the respective window-guide elements **6** and elements **6.6a** in engagement with the reinforced A-post section.

I) less stress to solve the problem of total deformation. By means of arrangement of interengaging assemblies of each vehicular couple in multi-operating planes and increase of vehicular couples comprising vehicle door & vehicle roof **17**, vehicle door & side rail **18**, vehicle door & post section/s and vehicle door & vehicle body **20** more vehicle members in compound construction are involved in energy absorption in different load cases in the event of any collision and/or rollover. In co-operation with another prior art the structural stiffness reaches the maximum. Beyond doubt, the advantage of keys *2.1, 5.6* & mating holes is due to the further exploitation of the very stiff impact beams **1, 7** to house the corresponding parts. Because the other vehicular couples comprising such as vehicle door & side rail and vehicle door & vehicle roof are not equipped with interengaging assemblies this *single* arrangement of one vehicular couple in mid region of door is insufficient in the event of any collision and/or rollover, therefore endangering the passengers in the following state of deformation

- intrusion of vehicle roof **17** into the vehicle body and of upper door frame **8.17**, thus squashing the passengers and
- buckling of the upper portion of the A-post section, total deformation of upper door frame **8.17**, buckling of vehicle roof **17** and buckling of side rails **18**, shown in **Fig. 8**.

In order to avoid the above-mentioned state a number of holes or keys **30** to **37** is arranged to the flange **21** *above*, *below* of the impact beams **1, 7** and *therebetween.* When the *non-adjustable* rivets *5.6* of the door hinges in x-z operating plane are replaced by a number of interengaging assemblies **15.1, 15.2a, 15.4, 30, 31** in numerous operating planes, the total stress of the vehicular couples: A-post section & vehicle door along the z-axis is lower owing to stress distribution, thereby preventing, to a certain extent, the A-post section and vehicle door from total deformation and gap „o", shown in **Fig. 8**.

J) measures against passenger ejection and total deformation of the vehicle members, whereby vehicle doors are not or less deformed, in real accident ref. to problem cases **E2** to **E4**, which can solely be solved by engagement of the following interengaging assemblies governed by permissible tolerances:

- holes & keys **15.3, 15.3a, 15.5a, 15.5** owing to U-shaped extension members **17.3, 18.3**, whose deformation causes a constrained deformation of the series-connected vehicle doors, vehicle roof and side rails;
- holes & keys **32, 33, 34, 30, 15.2, 15.4a** of the vehicular couple comprising vehicle door & B-post section in four operating planes; *and/or*
- hooks **15.6** & reinforcing rod **17.1d** of both vehicular couples comprising series-connected vehicle doors & side rail and series-connected vehicle doors & vehicle roof, so that the deformation of the side rail and vehicle roof causes a constrained deformation of the series-connected vehicle doors; and

by *energy transmission* into the other vehicle side by means of transverse girders **17.2, 17.2b, 17.2c, 17.2d, 18.2** of vehicle roof, side rails and all post sections facing each other, thus distributing the energy thereto.

K) passenger protection by engagement of vehicle couples in rear collision. Door detachment in rear collision occurred due to the lack of door hinges and interengaging assemblies. For the purpose of connection of vehicular members to each other the engagement of rear door **8B** with the C-post section is improved by rigidly arranging

- element **6.5C**, adapted to the outer door-contour and having holes to receive mating keys **37**, shown in **Figs.** 14, 18, to the door frame of rear door; and
- keys **33, 34** to window-guide element **6B**.

The features of vehicle door are, doubtless, suitable for tailgate door **8T**, sliding side door, liftgate door cargo door, trunk cover **8x**, hood **8h**, series-connected doors, e.g. three vehicle doors with four post sections of large van.

BRIEF DESCRIPTION OF THE DRAWINGS

A number of embodiments, other advantages and features of the present invention will be described in the accompanying drawings with reference to the xyz global coordinate system::

Fig. 1 is a side view of vehicle side, body, impact beams, keys, hooks, window-guides and window-guide elements (reinforcing elements).

Fig. 1A is a cross-sectional view of a vehicle door engaging with a roof and side rail ref. to DE-OS 2162071 in side collision.

Fig. 1B is a cross-sectional view of a vehicle door engaging with a side rail ref. to EP 0423465 A1 in side collision.

Fig. 2 is a side view of an U-shaped window-guide element, the position of keys 15.7, 15.8 and of an additional window-guide element 6.4, 6.4B.

Fig. 2A is a side view of an U-shaped window-guide element, the position of keys 15.7.

Fig. 3 is a perspective view of a front stiff door frame with both window-guides, both respective window-guide elements and interengaging assemblies of the 1st embodiment.

Fig. 3A is a cross-sectional view of a key equipped with an adjusting mechanism.

Fig. 4 is a perspective view of interengaging assembly hooks & reinforcing rod of the 2nd embodiment.

Fig. 4A is a cross-sectional view of the reinforcing rod and the mating hook equipped with an adjusting mechanism.

Fig. 5 illustrates a load case I in z-y plane in front collision of vehicle.

Fig. 6 illustrates a load case II in z-x plane in front collision.

Fig. 7 illustrates a load case III in x-y plane in front collision.

Fig. 8 is a state of total deformation of vehicle at displacement v in front collision.

Fig. 9 illustrates a load case IV in x-y plane in side collision of vehicle.

Fig. 10 illustrates a load case V in z-x plane in side collision.

Fig. 10A illustrates the mating parts of interengaging assemblies ref. to U.S. Pat. No 4,307,911, both mating parts of a door lock, the general force F_1 or S_1 in the event of front or side collision and a highway column.

Fig. 11 is a view of a compression-coil spring on a lower spring seat.

Fig. 12 illustrates the projection of the end coil and spring seat in a plane, the test results and FEM data of an end coil rolling on the lower spring seat in dependence on load.

Fig. 13 illustrates four collision types U1 to U4 ref. to the research work of Institute of Vehicle Safety, a Dept. of German Insurers Association, and a highway column.

Fig. 14 is a perspective view of interengaging assemblies of the 3rd embodiment comprising a stiff front door frame having a single window-guide element and a stiff rear door frame having a single window-guide element to engage with the post sections and flange of vehicle body.

Fig. 15 is a cross-sectional view of the series-connected doors in engagement with the A-, B-post section and of the vehicle body along the line D-D in **Fig.** 14.

Fig. 16 is a side view of the series-connected stiff door frames without window pane in engagement with the B-post section according to arrow E in **Fig.** 14.

Fig. 17 is a perspective view of interengaging assemblies of the 4th embodiment comprising a stiff front door frame having a single window-guide element in engagement with the flange of vehicle body.

Fig. 18 is a side view of the flange of vehicle body provided with keys.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Ref. to **Fig.** 3 the scope of the application of the window-guide elements of vehicle door is extended to accommodate the keys of interengaging assemblies, whose mating receptacles are arranged to any (A-, B-, C- or D-) post section, flange of vehicle body, vehicle roof and/or side rail. The positions of keys and mating receptacles may be interchanged if desired.

According to the prior art a stiff door frame of vehicle door can be assembled, without door girder and reinforcing elements, from at least two impact beams provided with interengaging assemblies and at least one window-guide element **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**. As is customary, the window-guides

6.1, 6.2, 6.1B, 6.2B, shown in **Figs.** 1 and 3, are made from U-shaped thin panel. As *reinforcing elements* the window-guide elements are of higher-grade tensile strength **6.1a, 6.2a, 6.1aB, 6.2aB** to:

- reinforce the U-shaped window-guides of metal sheets,
- receive parts such as hooks, keys and/or holes and
- receive elements **6.5, 6.5B, 6.6a, 6, 6b, 6.7a, 6.7b, 6.8, 6.9** (not drawn) as structural element with higher-grade tensile strength.

The elements **6.8, 6.9** ref. to **Fig.** 14 are fixedly attached to the front faces of both impact beams **1B, 7B** and window-guide element **6B**, the elements **6.6b, 6.7b** to window-guide element **6** and impact beam **7** and the elements **6.6a, 6.7a** to window-guide element **6** and between both impact beams **1, 7**.

Both window-guide elements are replaceable by an U-shaped stiff window-guide element **6, 6B**, shown in **Figs.** 2, 2A, 14 to 17. Less stiff elements **6.3, 6.3B** are normally made of panel. Alternately, very stiff window-guide element **6.3, 6.3B** serves to receive the window pane and keys **15.7**.

Window-guide element **6, 6B** provided with window-guide element **6.3, 6.3B** in the door cavity, shown in **Fig.** 2A, have open ends. To maximize the stiffness of window-guide element **6, 6B** both ends are rigidly connected to each other by window-guide element **6.4, 6.4B** in the door cavity, shown in **Figs.** 2, 14 to 17:

- after the window pane has been inserted, *or*
- by having flat profile, shown in **Fig.** 17, for the purpose of receiving window pane **60, 60B**, shown in **Fig.** 15. Later on, this window pane must be secured against falling down by protective parts.

The window-guide element **6.4, 6.4B** is useful for the accommodation of keys **15.8**. If extraneous weight is not that important for heavy cars, trucks and vans, the window-

guide element fastened to the impact beams serves as members of door frame to receive keys while the window-guides of panel guides and receives the window pane.

One of the solutions for the problem case **E4** and energy-distribution to both post sections, door **8, 8B**, roof **17** and side rail **18** as well as from one vehicle side to the other vehicle side is featured in the 1st embodiment by arranging

- key **15.1** to a reinforcing element of the L-shaped A-post section, welded to reinforcing panel **17.1c** arranged along the vehicle roof and to transverse girder **17.2d** of both facing A-post sections of both vehicle sides, and the mating oblong hole to window-guide element **6.1a**;
- keys **15.1** to reinforced A-post section and the mating oblong holes to window-guide element **6.1a**;
- keys **15.2** to window-guide elements **6.1a, 6.2a** and the mating holes to reinforcing panel **17.1a** arranged along the vehicle roof; and
- keys **15.4** to the reinforcing plate of reinforcing panel **18.1** arranged along the side rail, and the mating holes to window-guide elements **6.1a, 6.2a**.

In case of large-sized door it is recommended to arrange additional keys **15.2, 15.4** to window-guide element **6.3, 6.4** and the mating holes to the reinforced vehicle roof and the reinforced side rail, respectively.

Ref. to **Fig. 4** the 2nd embodiment consists of an interengaging assembly, the hooks of which are attached to two window-guide elements of each vehicle door and the mating rod to the vehicle roof, post sections of the door or all doors. The rod serves to reinforce the vehicle roof, sustain impact force and aid positioning on assembly, thus cutting costs. However, this embodiment needs space, which is available in large cars, trucks and vans. This embodiment is suited too for another vehicular couple comprising vehicle door/s & side rail.

The interengaging hooks **15.6** are bolted to window-guide elements **6.1a, 6.2a, 6.1aB, 6.2aB** and the mating reinforcing rod **17.1d** is arranged along the vehicle roof **17** and/or side rail **18**. When at least one pair of rods is welded to transverse girders **17.2e, 17.2f, 17.2g** of both A-, B- and C-post sections, energy can be distributed from one vehicle side to the other vehicle side in side collision, from the front to rear vehicle section of vehicle body **20** in front collision, from the rear to front vehicle section of vehicle body **20** in rear collision or to all parts of vehicle body **20** on rollover.

Ref. to **Figs.** 14, 17, 18 the 3rd embodiment consists of interengaging assemblies **30 & 6.5, 35 &6.5B** and other interengaging assemblies **32 & 6.9, 37 & 6.9B (6.9, 6.9B** similar to **6.5), 37 & 6.5C** for the purpose of avoiding large deformation of the edges of each door and of saving costs by exploiting the flange **21** of vehicle body **20** and the enlarged flange defined by the dotted lines "a1", "b1", "b2" and "c1". The keys **30, 32, 35, 37** are bolted to the respective reinforcing elements **21.1 to 21.5, 21.1B to 21.5B** of the flange **21** of vehicle body **20** and the corresponding holes are arranged to the housings **6.5, 6.5B** and/or auxiliary element **6.5C**, all of which are rigidly attached to the respective window-guide elements **6, 6B**, the respective elements **6.6b, 6.7b, 6.8, 6.9** (not drawn because of the similarity to **6.7b**) and/or the respective impact beams **1, 1B, 7, 7B**. The reinforcing element **21.5B** is welded to the flange and rear wheel case. The same reinforcing method can be employed to arrange a similar element **21.1** to the flange and the front wheel case.

Stiff door hinges in co-operation with impact beams **1, 7, 1B, 7B** and interengaging assemblies transmit forces of load case **I** from the front to rear vehicle section of vehicle body **20** in front collision. There is no door hinges to connect the rear door to the C-post section. To improve energy transmission from the rear to front vehicle

section of vehicle body **20** in rear collision, an auxiliary element **6.5C** is attached to the impact beams **1B, 7B**.

Instead of the bulky "engaging" bolt ref. to U.S. Pat. No. 3,819,228 these keys, configured in small size and distributed along the flange, neither spoil the overall design nor injure persons stepping in or out of the vehicle body.

The Technical Mechanical Method of constrained deformation is applied to secure the engagement of all vehicle parts with each other in the event of accident and to distribute impact energy thereto by means of two U-shaped extension members **17.3, 18.3**, located in common post section ref. to **Fig. 3**, whose keys **15.3, 15.3a, 15.5, 15.5a** are engaged with the mating apertures, arranged to the corresponding window-guide elements **6.2a, 6.1aB** of series-connected doors **8, 8B**, when doors are closed. This feature of the 4th embodiment prevents the disengagement of interengaging assemblies due to large inward deflection of vehicle body **20**, vehicle roof **17** or side rail **18**, above-mentioned in the problem case **E2, E3** or **E5**, when the doors are subjected to little or no deformation. As connection element of the common post section and the vehicle roof, this U-shaped extension member **17.3** is welded to reinforcing panel **17.1b**, arranged along vehicle roof **17**, and to transverse girder **17.2c** of both facing common post sections of the vehicle sides. As connection element of the common post section and the vehicle floor this U-shaped extension member **18.3** is welded to reinforcing panel **18.1b**, arranged along the vehicle floor, and to transverse girder **18.2** of both facing common post sections of the vehicle sides. The belt case **26** can be housed in the U-shaped extension member **18.3**.

Due to the arc-travel path of the door about the mutual axis of door hinges the mating surfaces of key and receptacle of each interengaging assembly, proposed by U.S. Pat. No. 5,806,917, are configured in four tapered forms or two curved and two tapered forms, thus yielding eight tolerance zones, high manufacturing and assembling

costs as well as making tight engagement impossible resulting in door detachment in accident. To resolve these problems straight (non-curved, non-inclined or non-tapered) engaging surfaces are proposed for key and receptacle. The purpose of assembling and adjusting any key, shown in **Figs.** 3, 3A, 4 and 4A, from outside of the vehicle body **20** is to substantially cut labour time and costs. Costs can be enormously lowered by using mechanical connecting parts, particularly standard parts like washer (ref. to DIN 125), hexagon socket head screw (ref. to DIN 912) etc. With the exception of **15.4a** each key **15.1 to 15.5a, 15.7, 15.8, 30 to 37** comprises a screw **15.14**, a sleeve **15.11**, a number of washers built into one spacer **15.12** and a washer with a large exterior diameter **15.13**, illustrated in **Figs.** 3A, 14 to 18. In order to ensure the engagement of key with mating hole a protrusion „x_m" and circumferential clearance „c_c", explained in the next section, must be preserved by:

- correcting the length of spacer „l" by removing or adding washers and/or
- assembling a sleeve with exterior diameter „d", washer with exterior diameter „D" and/or spacer with diameter „d_R".

If desired, the sleeve **15.11** and spacer **15.12** can be made of soundproofing material.

Each hook **15.6**, shown in **Figs.** 4 and 4A, comprises a hook **15.20** with interior diameter „d_1" and gap „s_1", smaller than „d_1", a screw **15.21**, a number of washers built into one spacer **15.22**, a coil-spring washer **15.24** and a nut **15.25.** The symbols „s_1", „d_1" and „d_2" are shown in **Fig.** 4A. In order to ensure perfect engagement of the hooks with reinforcing rod **17.1d**, having diameter „d_2" smaller than „s_1", small tolerance zones, shown in **Fig.** 4A, must be preserved by:

- assembling a hook with gap „s_1";
- assembling a rod with diameter „d_2";
- correcting the distance „l_1" by removing or adding washers; and/or

– positioning the centres of the hook hole and the reinforcing rod out of alignment.

Fig. 15 exemplifies a new feature of numerous different planes, wherein the interengaging assemblies of any vehicular couple comprising e.g. the common or B-post section and the series-connected vehicle doors **8, 8B**, operate. When the doors are closed, key **33** protrudes the mating hole by „$-x_m$" (minus sign in respect to the opposite x-direction), which is limited due to the arc-travel path of the door about the axis of door hinges. The clearances of key **33** and the mating hole are denoted by „$-y_m$" and „y_p". The protrusion „x_m", circumferential clearance „c_c" (not drawn, represented by „$-y_m$" and „y_p" in y-direction) of the mating parts of each assembly and operating plane play a significant role on tight engagement thereof in accident. In the accident, above-mentioned in the problem case **E2** or **E3**, the door becomes detached due to large circumferential clearances of all mating parts of interengaging assemblies, which operate in the same z-y plane, and large inward deflection of the vehicle body **20** or side rail **18** in the opposite x-direction, during which under the load of inertia forces of the passenger the door is opened and moved in the arc-travel path about the axis of door hinges. Door detachment can be prevented by minimum tolerances, whereby the mating parts of interengaging assemblies of any vehicular couple, acting in the same operating plane, are governed.

In this time- and cost-saving feature against door detachment, proposed for the following embodiments, many interengaging assemblies of any vehicular couple comprising e.g. interengaging assemblies keys **32, 33, 34** & mating holes, must operate in numerous different planes, where the deformation of door **8** results in a tight engagement of keys **32, 34** with the mating holes, taken, the worse case is given, that all keys **33** fail to engage with the mating holes. The interengaging assemblies, comprising keys **32, 33, 34** & mating holes, operate in three different planes, the number of which can be increased by arranging these interengaging assemblies in the

planes, which, however, are offset to each other, e.g. in offset z-y planes. The interengaging assemblies keys **35** & holes act in the fourth operating z-y plane and keys **36** & holes in the fifth operating z-x plane. Owing to this feature the minimum tolerances of "narrow" are outdated, hence, replaced by permissible tolerances of "less narrow", "far less narrow", "small" and/or "medium", thus significantly lowering the reject rate, assembly time and costs. Advantageously, a pattern of the interengaging assemblies, governed by permissible tolerances, can be issued in a table handed to assembly workers. Alternately, this pattern can be coded in the assembly program to drill, position and assemble parts thereof within the permissible tolerances. The constant, small contour clearance and the proper tolerance between door lock **248** and striker **298**, above-mentioned in the problem cases **D** and **E**, can easily be accomplished at the assembly line within short time, thus making rework as well as adjustment work superfluous. It should always be reckoned with a reject when the assembly tolerances are, unexpectedly, larger than the permissible tolerances. Adjustment work for the interengaging assemblies of the rejected car can be done outside of the assembly line, thereby maintaining the production process and low reject rate. All these advantages outweigh the costs of extra material for a larger number of interengaging assemblies.

A washer **15.13** with radial teeth, serving as part of key **33**, clamps in the inner region of the reinforced B-post section in any collision or on rollover. As an integral part of a screw ref. to DIN 931 Form Z the washer won't come loose on assembly.

Costs can be cut by positioning an unadjusted key between adjustable keys, such as rivet **15.4a** ref. to DIN 660, fastened to the reinforcing plate of reinforcing panel **18.1a** arranged along the side rail. However, when the number of the interengaging assemblies is limited in a low-cost configuration, for perfect interengagement the provision with keys **15.1 to 15.8, 30 to 37** without key **15.4a** is ultimately necessary.

Large total stress of the load cases **I to III** results in total deformation (buckling) of the post sections, side rail, vehicle roof and/or doors because stress of vehicle body and doors in an arbitrary real collision can never be predetermined in the research as well as in the three crash tests, above-mentioned in the problem case **E4**. To resolve such indeterminate stress the vehicular couples comprising front post section / door **8, 8B**, rear post section / door **8, 8B**, vehicle roof **17** / door **8, 8B** and side rail **18** / door **8, 8B** must be equipped with many interengaging assemblies operating in numerous different planes, such as keys **30** & holes acting in the first operating z-y plane, keys **31** & holes acting in the second operating z-x plane, key **15.2a** & hole, shown in **Fig. 3**, acting in the third operating z-y plane and in co-operation with additional interengaging assemblies, comprising keys **15.1, 15.2, 15.3, 15.3a, 15.4, 15.4a, 15.5, 15.5a, 15.6 to 15.8, 32 to 37** & receptacles, in the above-mentioned embodiments.

Although the present invention has been described and illustrated in detail, it is clearly understood that the terminology used is intended to describe rather than limit. Many more objects, embodiments, features and variations of the present invention are possible in light of the above-mentioned teachings. Therefore, within the spirit and scope of the appended claims, the present invention may be practised otherwise than as specifically described and illustrated.

Fig. 15

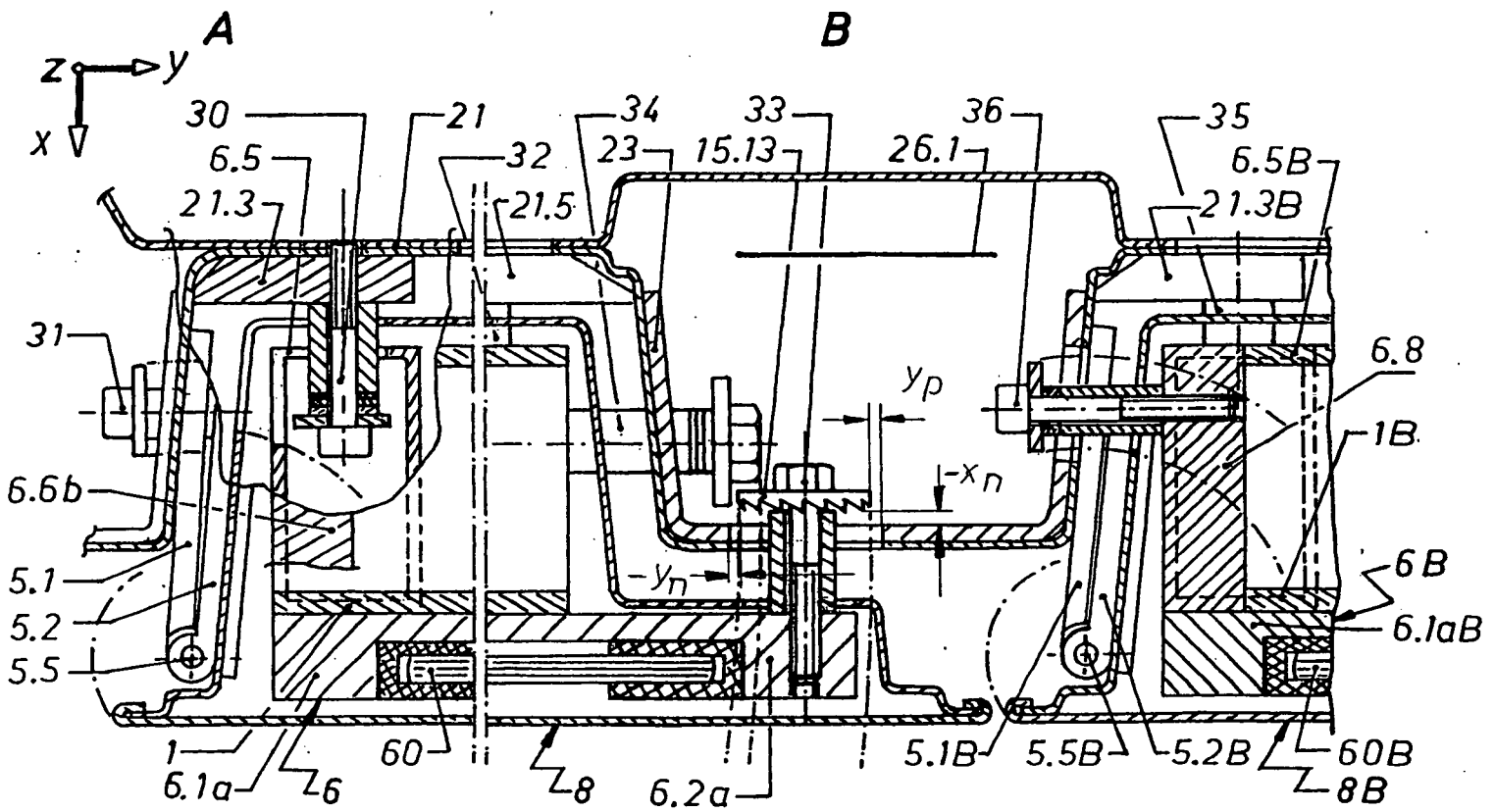
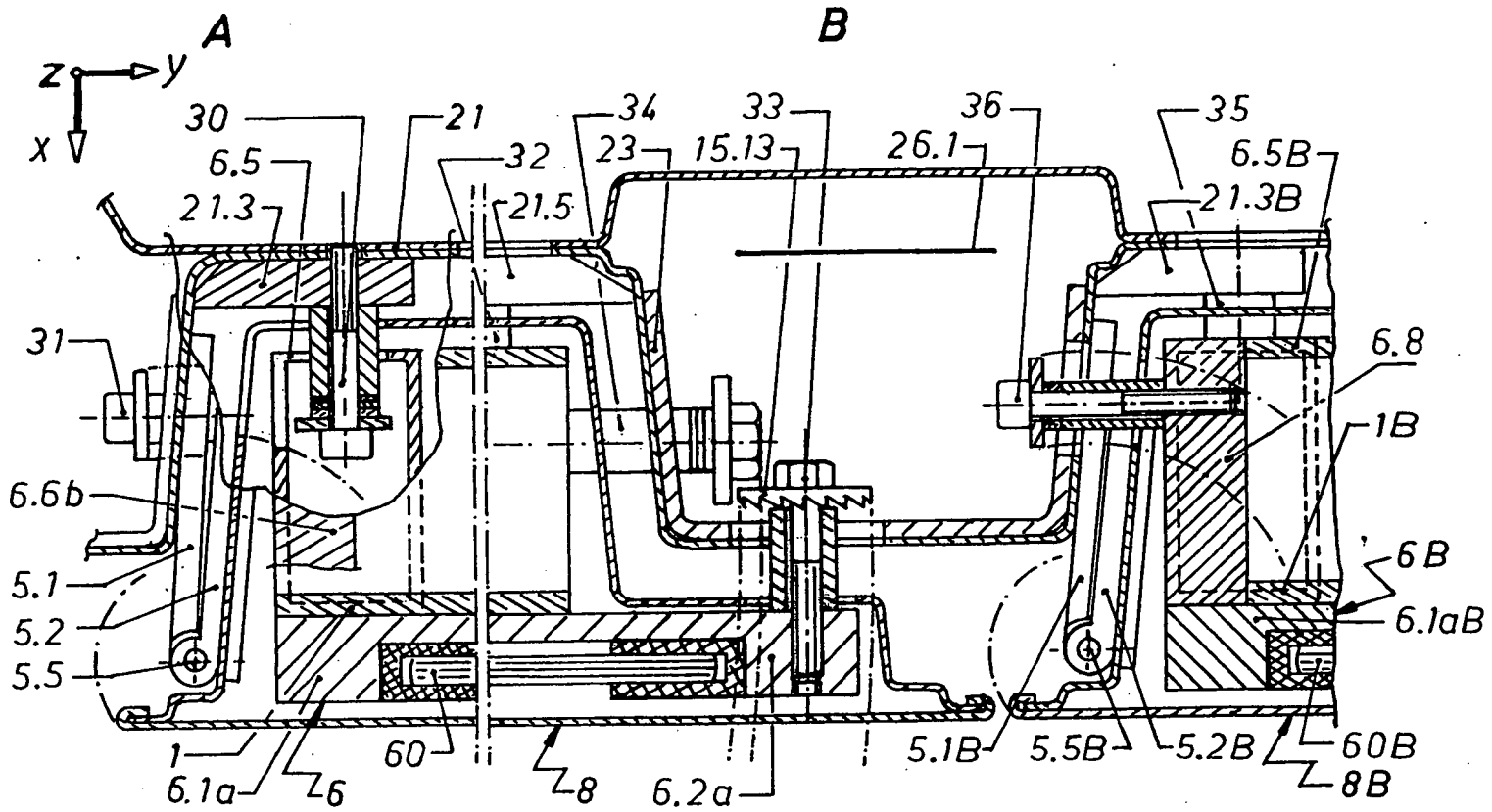

A
B
z
y
x
30
6.5
21.3
21
32
21.5
34
23
33
15.13
36
26.1
35
6.5B
21.3B
31
6.6b
5.1
5.2
5.5
1
6.1a
6
60
8
6.2a
y_p
$-x_n$
$-y_n$
6.8
1B
6B
6.1aB
5.1B
5.5B
5.2B
60B
8B

Fig. 15

not yet amended.
Origin.



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• **Comments:** Go, please review the changes I have made to the specification. I have not corrected the entire document, but I have tried to give you an idea of the changes I would like you to make on pages 1-7. Try to eliminate the references to specific vehicle crashes and instead concentrate on the general reasons why the invention is unobvious and useful. You do not need to use evidence to support your conclusions in the Background of the Invention. Your statement and oath is evidence enough. The purpose of the Patent is not to scrutinize your research, but merely to describe your invention such that someone of ordinary skill will be able to understand and reproduce it.

Accordingly, the Description of the Preferred Embodiments section of the Patent is more important. The purpose of this section is not to simply list the parts. Please avoid doing this. It is unnecessary. Do not explain in words what can be seen in the drawings. Instead, explain the reasoning for the invention to be constructed in the manner it is and the function of the various parts. It is necessary to explain clearly how the invention works. Avoid listing parts and stating what is attached to what. This section should be NARRATIVE and EASILY UNDERSTADABLE. Do not use "listing" as shown in lines 17-31 of page 13.

In short, please revise the entire specification, removing unnecessary information from the Background of the Invention and concentrating on the Description of the Preferred Embodiments. Keep in mind that NO NEW MATTER may be entered into the case at this point.

When you have completed the revision of the specification, please contact me again and let me know when you will fax me the revised draft to (703) 308-3297.

INCREASED STIFFNESS OF VEHICLE STRUCTURE IN ACCIDENT

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part application of co-pending international application number PCT/DE 96/02120 filed Nov. 7, 1996 and claiming the priority of DE 19543706 A1 filed Nov. 17, 1995. ~~This PCT/DE 96/02120 (WO 97/18984) is revised and refiled 06/03/97 and 07/08/97 for the purpose of amending the drawings, description, claims and contesting the prior art ref. to the German examination report of 09/09/96 and PCT search report of 03/24/97; 12/09/97 in order to correct and list the opposed prior art documents DE-OS 4342038 A1, DE-OS 2162071, U.S. Pat. No 4,307,911 (DE 3103580 A1), U.S. Pat. No 3,819,228, EP 0423465 A, EP 0642940 A (Patent family member U.S. Pat. No. 5,518,290), EP 0659601 A and DE 3726292 C1 in compliance with the PCT rules ref. to the preliminary PCT examination report of 10/02/97 and 12/07/98 in order to correct and list the opposed prior art documents U.S. Pat. No 3,788,686, U.S. Pat. No. 3,819,228, U.S. Pat. No 4,307,911, U.S. Pat. No 4,676,524, U.S. Pat. No 5,306,067, U.S. Pat. No 5,806,917, DE-OS 2405875 and DE 4240416 A1 ref. to U.S. examination report of 10/14/98.~~

~~The abbreviations DE and EP denote the German Pat. Application or Document and European Pat. Appl. or Doc.; which will be omitted hereinafter.~~

~~All mentioned Pat. Appls./Docs, a 53-page report to the EU-Commission, US-, Canadian and Japanese Ministries for Transport, all accident reports by newspapers, German Police and the inventor listed in the Chap. "OTHER PUBLICATIONS" are parts of submittal.~~

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to vehicle doors and, more particularly, to interengaging assemblies which structurally integrate all vehicle doors, when closed, with the vehicle roof, both side rails (sill portions) arranged along the vehicle floor, all post sections (pillar portions) and the flanges of door apertures of vehicle body ~~(passenger compartment or cell)~~ thereby distributing energy to all those vehicle members, lowering stress thereof, preventing passenger ejection and enhancing survival chance in the event of any collision (front, side and/or rear collision) ~~and~~/or rollover ~~(overturn)~~.

2. Discussion of the Prior Art:

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"*series-connected doors*"	doors of one vehicle side are series-connected
"*girder*"	panel, shell, beam etc. according to FEM and Technical Mechanics

"*window-guide elements*" of vehicle doors	window-guides **6**, **6B**, **6.1**, **6.2**, **6.1B**, **6.2B**, **6.1a**, **6.2a**, **6.1aB**, **6.2aB**
"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body
"*mating parts of interengaging assembly*	mating parts of an interengaging assembly such as key & receptacle, hook & recess, hole & key or hook & rod
"*engaging hole*"	aperture, slot, oblong hole
"*vehicular couple*"	two mating vehicle members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & flange (transition region) of vehicle body, vehicle door & post section/s, vehicle door & vehicle door in engagement in the event of any collision and/or rollover

It is known in the prior art to provide interengaging assemblies to engage and/or clamp the vehicle door with the mating vehicle members, when the vehicle door is in closed position, thus distributing energy, lowering stress whilst enhancing survival chance only in the event of either mid-front collision or side collision of type U2, one of four types shown in **Fig.** 13. However, all these conventional configurations do not take into account the failure of passenger protection due to the following problem cases in conjunction with disengagement of the mating parts of interengaging assemblies from each other in the event of all types of real collision (any real collision) and/or real rollover:

- **A** Load cases **I** to **V** according to Technical Mechanics/FEM in real front, side and rear collision;
- **B** Wrong assumption of the prior art for the purpose of idealizing a general side energy S or S_1 to a single energy S_x or S_{x1};
- **C** Analogy between the state of non-contact and disengagement;
- **D** Constant, small contour-clearance and assembly tolerance zones;
- **E** Large clearances of interengaging assemblies;
- **E1** The first inventions of interengaging assemblies, huge production costs and fatal injury in real collision due to large clearances;
- **E2** Large deformation of vehicle structure or door **8**. **8B** in real collision;
- **E3** Large deformation of side rail **18** in real collision;
- **E4** Large deformation of upper door frame **8.17** and vehicle roof **17** in real collision;
- **E5** Intrusion of vehicle roof **17** in vehicle body **20** in real rollovers; and
- **E6** Clamping assemblies or adjustable interengaging assemblies to resolve problem case **E**.

Evidence for failure of the prior art, resulting in door detachment associated with passenger ejection and intrusion of vehicle members and/or power plant (drive assembly) associated with severe/fatal injuries, is listed in the 53-page report [1] for the purpose of minimizing injury-severity level, number of injuries and injury-related costs, over $ 1 billion per day, in real accidents of vehicles world-wide, some of which, having always achieved very good to best verdicts in the front crash tests, are German and Volvo cars known world-wide as the safest. NHSTA [19] has confirmed the correctness of the theses and commitment therefor.

Problem case A: In order to idealize an impact force $2F_1$ in Fig. 10A imposed on a vehicle structure the following assumptions must be specified:

- let the vehicle structure be idealized by two symmetric vehicle halves subjected to an front impact force 2F along the centre line.

Load case I in z-y plane in Fig. 5: The moment $M_x = H*h$ about the x-axis is replaced by a pair of forces $H_A = (H*h)/l$ with the lever arm of l. Employing the equilibrium condition for moments two forces of reaction are obtained: $V_A = (V*l_C)/l$ and $V_B = -V_A + V$. Acting in z-direction with respect to the sign are three shear forces: -V, $(H_A + V_A)$ and $-(H_A + V_B)$. Under load of these forces the vehicle side, comprising all post sections, series-connected doors 8, 8B reinforced by impact elements and interengaging assemblies of those doors and post sections, is subjected to the bending moment along the y-axis.

Load case II in z-x plane in Fig. 6: The force V exerts bending moment M_{zx} along the x-axis and rotating moment $M_y = V*b$ about the y-axis acts as torsional moment along the vehicle side.

Load case III in x-y plane in Fig. 7: The A-post section is under load of rotating moment $M_{xy} = -H*b$. The vehicle side is subjected to bending moment M_{xy} along the y-axis and buckling force H.

Subjected to the total stress of bending moments M_{zx}, M_{xy}, M_{zy}, buckling force H and torsional moments M_z, M_y in the load cases I to III, the vehicle side in Fig. 8 is deformed in real front collision.

By reversibly arranging the series-connected doors 8, 8B the same load cases are obtained for real rear collision.

Load case IV in x-y plane in Fig. 9: Under load of side impact energy S at impact angle α 27° according to FMVSS 214 or in the event of real side collision the vehicle side is subjected to bending moment M_{xyS} along the y-axis and lateral force S_y.

Load case V in z-x plane in Fig. 10: Under load of side impact energy S at impact angle γ or in the real side collision against a tree or highway column 22 in Fig. 10A, 13 the vehicle side is subjected to bending moment M_{zxS} along the z-axis and lateral force S_z.

The total stress consists of the stresses in load cases IV and V.

Problem case B: ~~With the exception of DE 4342038 A1,~~ the prior art is governed by the following assumptions:

- let clearances between mating parts of an interengaging assembly be neglected and
- let the load cases IV and V be idealized to a lateral energy S_x in Fig. 9 or S_{x1} in Fig. 10A imposing on the *centre* of vehicle door, illustrated as collision type U1 in Fig. 13, despite four collision types U1 to U4 [15] and the collision type U2 having the highest percentage of severe and fatal injuries. Nevertheless, car manufacturers and suppliers world-wide have adopted this idealized S_x or S_{x1} in inventions e.g. U.S. Pat. No. 4,307,911, U.S. Pat. No. 5,806,917, U.S. Pat. No. 5,518,290 (EP 0642940 A, DE 3934524), whose shortcomings are mentioned in the following problem case E2.

Problem case **C**: As exemplified in [2], reproduced in **Figs.** 11, 12, both end coils of compression-coil spring **19** are guided by two spring seats **19.1**. Their utmost outer nodes KN_1 and KN_{End} (not drawn) rest against both stops **19.3**, where i represents the number of coils. To survey the rolling behaviour of end coil **19** on the lower spring seat **19.1** the end coil is idealized in elements by supporting springs in reference to the nodes and by the threshold value of the distance in the "state of rolling" $s < 0.1$ mm. **Fig.** 12, [2] illustrate the rolling behaviour in regard to the FEM data and test results marked with M in dependence on $F_z = -790$, -1000 and -3000 N:

- According to test results KN_2 to KN_5 roll on the spring seat at $F_z = -790$ N, but in the state of non-contact at $F_z = -1000$ and -3000 N.
- According to FEM data the nodes in the following states are in dependence on F_z:

F_z	State of contact	State of rolling
-100	KN_1, KN_{15}, KN_{17}	KN_1 to KN_3, KN_{10} to KN_{18}
-250	KN_1, KN_{19}, KN_{20}	KN_1, KN_{15} to KN_{23}
-1415	KN_1, KN_{17}, KN_{19}, KN_{20}, KN_{30}, KN_{31}, KN_{33}, KN_{34}	KN_1, KN_{15} to KN_{35}

When both end coils roll on the mating spring seats upon increase of energy, some nodes/elements thereof, previously in the state of contact, are in the state of non-contact. Analogously, interengaging assemblies are exposed to the disengagement.

Problem case **D**: Recently in automotive industry, great efforts have been made to achieve (finish) a constant (uniform), small contour clearance [16] between the outer door-contour "abcde" of vehicle door **8**, **8B** and the door aperture of vehicle body **20** in **Fig.** 5. in order to minimize flow noise and, particularly, to achieve sales success in co-operation with an overall impression of attractive design. In the state of assembly the contour clearance e.g. of AUDI ® vehicles is only 2.5 mm and of VW Passat ® 3.5 mm, ~~0.5 mm less than Japanese vehicles according to VW CEO Dr. Piech [17].~~

For the purpose of automatic assembly with the above-mentioned goal, a device ref. to DE 3726292 C1 determining six reference points on the outer door-contour calculates the differences between the outer door-contour and the door aperture (opening) of vehicle body **20** within the assembly tolerances by assembly, disassembly and assembly of the same vehicle door in **Fig.** 18.

Problem case **E**: The ~~position D, of~~ door lock **248**, rigidly attached to vehicle door **8**, and the ~~position B, of~~ striker **298**, rigidly attached to post section illustrated as B-post section in **Fig.** 10A of U.S. Pat. No 4,307,911 representing the prior art, is provided with locking clearances in x-, y- and z-direction, thus ensuring the state of door locking and the normal operation of vehicle door. For the purpose of preserving the constant, small contour-clearance,

- the position D_a to D_c of each key **128a** to **128c**, rigidly attached to vehicle door **8**, and the position S_a to S_c of mating receptacle **158a** to **158c**, rigidly attached to lower stiff panel **156** of side rail **18**;
- the position D_n of key **148**, rigidly attached to vehicle door **8**, and the position B_n of mating receptacle **198**, rigidly attached to post section,

must be provided with position-tolerances, larger than locking and assembly tolerances, in x-, y- and z-direction in order to avoid

1. interference with the locking operation of door lock **248** to striker **298** when closing vehicle door **8**;
2. expensive reworking at the assembly line;

3. customer complaints due to disturbing noises [3]. Due to the small distances of overlaying coils denoted as w ≤ 0.2 mm in Fig. 1I, noises such as rattle etc. [3] occur at different oscillations when driving. This condition is comparable with the distances of the mating parts of interengaging assemblies to each other; and) RELEVANCE UNCLEAR
4. high reject rate due to different references of coordinate system of vehicle door, finished by two to three suppliers and transported to assembly line, and of vehicle body 20, finished at the assembly line. Huge costs are necessary to computerize design data of vehicle door and structure in data files, which must be evaluated by innovative programs to minimize those position-tolerances and reject rate, however, under the condition of the constant, small contour-clearance.

Noteworthy: A pin, in free connection with a king-size hole, under load can never engage therewith due to large tolerance. A prerequisite for engagement is small tolerances (clearance) of mating parts in x-, y- and z-direction. Examiners of German and European Patent Office as well German and European engineers classify such engagement or connection governed by small tolerances as form-locking connection. Omit

Problem case **E1**: According to ~~the first invention of the largest German Corp. having over 100 years of experiences of building luxury cars ref. to DE-PS 1755611 of 06/06/68~~, the taper-formed key **148** and the mating receptacle **198** should be in engagement or form-locking connection ~~("Verbindung" in Claim 1)~~ to ensure energy-transmission from one post section to the other.

Because receptacle **198** and striker **298** are formed together in one piece, an adjustment of receptacle **198** changes the position of striker **298** to the door lock **248** as well as the clearance therebetween, which becomes too large or small. In order to properly latch and lock the vehicle door to vehicle structure the "interengaging" assembly is provided with large tolerance zones, thus violating the condition of the aforementioned feature.

When ~~a luxury vehicle [11] of this Corp. driven on a slippery icy road~~ laterally crashed ~~against a truck,~~ the key **148** ~~disengaged~~ from mating receptacle **198** due to large clearance so the remaining energy totally ~~deformed~~ the vehicle door, whose intrusion fatally injured the driver.

~~At the end of the~~ 80's the Corp. decided to stop the production of over 20 million "interengaging" assemblies, ~~wherewith over five-million~~ vehicles had been equipped within two decades. A problem of two tolerance zones remains ~~unresolved and is very costly~~.

According ~~to the second invention of the 2nd largest Japanese car Corp. ref. to DE-OS 2162071 of 07/06/72 in~~ **Fig.** 1A, contour tongues **16.1** should be in engagement with contour grooves **16.2** in order to integrate vehicle door **8, 8B** into side rail **18**, vehicle roof **17** and B-post section in side collision. Without "interengaging" assembly of the vehicle door and B-post section, the normal operation of vehicle door would be possible if the outer door-contour "abcde" were square. Regarding the recent contour design in **Figs.** 5 and 18 the line "ab" is generally curve-shaped, line "bc" of front door upwardly inclined ($\beta > 90^0$) or generally curve-shaped and line "bc" of rear door generally S-shaped, so contour grooves **16.2** would interfere with contour tongues **16.1** when closing the vehicle door.

Furthermore, to sustain large impact energy it is necessary to reinforce the wide contour groove by an element which, unfortunately, can't be attached to the narrow upper region of door frame **8.17**.

~~If this invention were really useful, why had the Corp. not implemented it in each of two sport utility vehicles, whose vehicle structure collapsed and steering column intruded into vehicle body 20, in 40 % offset crash test [1] at low speed of 50 km/h conducted by ADAC?~~

According to the ~~first~~ U.S. Pat. No. 3,819,228 ~~of the largest Italian car Corp. of 06/25/74~~ a bulky "engaging" bolt rigidly attached to a stiff inner panel of vehicle door 8 projects through a hole of a stiff element attached to side rail 18 when the door is in closed position. The problem of large tolerance zones remains unresolved. Moreover, the overall stylish impression spoilt by a bulky "engaging" bolt will, doubtless, not be beneficial to sales. When stepping in or out of the vehicle body while cleaning or repairing, the person can ~~injure~~ himself when stumbling over this bulky bolt. When closing the door the danger of damage to clothing and injury to passengers, particularly when it is dark, is apparent

~~If this invention were really useful, why had the Corp. not implemented it in the latest compact car, whose vehicle structure collapsed in a real front collision [14] and in 50 % offset crash test [1] at low speed of 55 km/h conducted by Auto Motor und Sport, wherein the femur force of 15100 N would fracture both legs?~~

Problem case E2: ~~Both luxury cars [6, 7], a convertible car [10], U.S. Pat. No. 5,518,290 (EP 0642940, DE 4330620) and U.S. Pat. No. 4,676,524, which are described in this Chap., belong to a well-known car manufacturer having HQ in South Germany.~~

~~All four passengers, where one of them was instantly dead at the accident site, were hurled out of a brand-new luxury car [6] colliding into a tree in Wiesbaden City and rolling over.~~ Under load of force F_1 in Fig. 10A the deformation of vehicle structure, particularly in y-direction, was larger than that of each vehicle door whose catching hook 148, rigidly attached to impact beam 1, 1B, and door lock 248 were disengaged from the mating recess 198 and striker 298, all of which were arranged to post section.

In a real side collision of another ~~luxury~~ car ~~[7] of the same car manufacturer~~ into a tree, great energy totally deformed the vehicle side whose intrusion fatally injured both passengers. Obviously, the lateral force, deviating from the idealized force S_{X1}, could not force catching hook 148 to penetrate into recess 198 in order to define an "interengaging" assembly ~~ref. to U.S. Pat. No. 5,518,290~~.

Both real accidents resulting in severe/fatal injuries verify the shortcomings of any patent valid only for survival chance under load of an idealized force S_{X1}, denoted by arrow A in Fig. 1 of U.S. Pat. No. 5,518,290. Taken as given, the mid region of door is secured to the B-post section by the "interengaging" assembly in an "idealized" accident, the upper, lower door frame 8.17, 8.18, the vehicle roof 17 and side rail 18 are overstressed due to lack of interengaging assemblies. Moreover, problem cases E3 to E6 remain unresolved.

As exemplified by U.S. Pat. No. 4,676,524, a pair of vertically supporting window-columns, rigidly mounted in both vehicle doors 8 of a convertible car is in abutting, "engaging" relationship with both termini of upper member of cowl, when both vehicle doors are in closed position, owing to a pair of "interengaging" assemblies, each of which consists of

1. a receptacle of the terminus of the upper member and a locking mating tip of key of the window-column pressing therein in the first embodiment; or
2. a king-size hole of the terminus of the upper member and a mating key of the window-column having a mushroom-shaped head being in free connection therewith in the second embodiment

for the purpose of enhancing survival chance in rollover.

When the convertible car rolls over,

1. great shear force fractures each locking tip of key; or
2. great impact energy totally deforms each "interengaging" assembly, whose key and king-size hole are in disengagement ~~ref. to Chap. "Noteworthy",~~

thereby totally deforming the cowl and pair of window-columns.

The stiffness of ~~such~~ an open roof of a convertible car [10], merely supported by a pair of post sections in force-locking or free connection with one pair of small-size window-columns, is

- very low, thereby resulting in fatality in a real rollover thereof;
- lower than that of a rotatable, stiff rollover bar ~~ref. to U.S. Pat. No. 5,284,360 (DE 4130470 C1) solely implemented in convertible cars of the largest German Corp~~.,
- far lower than that of the closed roof 17 supported by two pairs of post sections ~~of the safest sport car [4] ref. to problem case E6 and~~
- substantially far lower than that of the roof construction according to the invention [ref. to DE 4344604 C1] to reinforce the closed roof 17 strongly supported by three pairs of reinforced post sections ~~of the safest, top luxury car [12] whose passengers were instantly dead in a real rollover ref. to problem case E5.~~

Do not reference, describe

Problem case E3: Due to great energy in a real side collision against column 22 of a central barrier in Fig. 10A, 13 on a highway

- large deformation of side rail 18 and rear section ~~of a brand-new two-seater German top-model [5] of the largest European car manufacturer~~, opposite to x-direction, caused the disengagement of the driver's less deformed vehicle door 8 from vehicle structure and later on
- the vehicle [5] rolled over three times across the highway and down-hill, thus totally deforming vehicle structure, doors 8, tailgate-door 8T, out of which both rear passengers were hurled, and, alternately, opening and closing both vehicle doors 8, out of which both front passengers were hurled out.

Grass 70 clamped between each post section and each vehicle door 8 in Fig. 8 was an evidence for the alternate opening and closing of both vehicle doors 8 during the rollovers.

In a side collision of a ~~small German~~ car [8] into a tree great energy totally deformed vehicle door 8 whose intrusion severely/fatally injured the passengers.

In a collision of another car [9] into a hill great energy totally deformed the right side rail 18 thus resulting in the disengagement of the door lock 248 and, if provided, interengaging assemblies too and later on totally deforming vehicle structure during rollover. The driver was hurled out of this car.

Problem case E4: In front collision or crash test impact energy deforms, in general, upper door frame/s 8.17 outwards and vehicle roof 17 upwards, thereby creating a gap o in Fig. 10A and preventing front vehicle door/s 8, 8B and/or vehicle roof 17 from transmitting energy to vehicle body 20.

Three different states of deformation are reproduced in three crash tests, conducted by ADAC, of the German vehicles of the same type [18] 40 % offset crashed at the same speed of 50 km/h against

- a very stiff barrier,
- a deformable barrier and
- another vehicle of the same type

because the uniform load, deformable property of two colliding masses, impact condition etc. are different. The gap o having three different sizes in Fig. 8 verifies the above-mentioned thesis of non-transmission of energy.

In side collision impact energy deforms, in general, upper door frame/s 8.17 inwards thereby inflicting injuries on head.

Problem case **E5**: During rollover of the top luxury car [12] of the largest German Corp. several times, impact energy totally deformed vehicle roof **17** whose intrusion severely or fatally injured both front passengers, whose heads were, definitely, crushed by falsely deployed airbags, and the remaining energy totally deformed vehicle body **20** and doors **8, 8B, 8T, 8x**.

Problem case **E6**: Responsive to problem case **E**, a clamping assembly ("Verkrallungspaar"; "Türverkrallung" = door clamping. "verkrallen" = to clamp) of EP 0423465A1 illustrated in Fig. 1B comprises

- a stiff hook of stiff ledge **25.2** rigidly mounted to lower door frame **8.18** and
- a thin mating panel of a stiff plate **25.1**, rigidly attached along sill rail **18**, serving as a site of predetermined fracture.

In excess of predetermined value in real side accident, the mating parts **25.1, 25.2** of interengaging assemblies are in the state of clamping to ensure the permanent engagement of lower door frame **8.18** with sill rail **18** in order to resolve the problem of passenger ejection. The proprietor, a German sport-car manufacturer, has built, beyond doubt, the safest sport cars in the world. Load cases **I** to **III, V** and problem cases **E2** to **E5** remain unresolved. Furthermore, there is no space to house both mating parts **25.1, 25.2** in vehicle roof **17** and upper door frame **8.17** subjected to lateral load F_o in real accident. The lack of interengaging assemblies became obvious in the rollover of its classic, very expensive sport car [4], which plunged seven meter downwards and crashed with vehicle roof **17** at a lower

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" CIPO "

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Application No.	:	**2,220,872**
Owner	:	GO, GIOK DJIEN
Title	:	VEHICULE DOOR FOR CAR AND TRUCK
Classification	:	B60J-5/04
Examiner	:	**B.M. Brown**

IN ACCORDANCE WITH SUBSECTION 30(2) OF THE PATENT RULES, YOU ARE HEREBY NOTIFIED OF A REQUISITION BY THE EXAMINER. IN ORDER TO AVOID ABANDONMENT UNDER PARAGRAPH 73(1)(A) OF THE PATENT ACT, A WRITTEN REPLY MUST BE RECEIVED WITHIN 6 MONTHS AFTER THE ABOVE DATE.

This application has been examined taking into account applicant's correspondence dated Sep. 3, 2001.

The number of claims in this application is 34.

35

In order to expedite prosecution attached is a sample set of claims which the examiner may find allowable. These claims are identical to the allowed European claims except they are in a form that would meet the Canadian Patent Act and Rules.

The examiner has identified the following defects in the application:

A search of the prior art has revealed the following:

Reference Applied:

United States Patent 5,806,917	Sep. 15, 1998	Townsend

Townsend discloses a motor vehicle chassis comprising a hinged door which is integrated with a structural part of a main chassis. Wedge shaped structural keys are located on the forward and rearward edges of the door and engage mating receptacles on a door jamb. Adjusting mechanisms are provided for adjusting the clearances of interlocking assemblies which are in engagement when the vehicle door is in a closed position.

Claims 1 to 5, 14, 23, and 34 do not comply with Paragraph 28.2(1)(b) of the Patent Act because these claims include subject matter disclosed in Townsend before the claim date.

Claim 34 is indefinite and does not comply with Subsection 27(4) of the Patent Act for being directed to the desired result rather than to the combination disclosed to achieve that result. Perhaps it was intended that claim 34 depend on claims 1 to 33.

In accordance with Subsection 81(2) of the Patent Rules, all documents referred to in the description of an application must be available to the public. Reference to the document on page 1 must be deleted or replaced by its corresponding patent number.

Under Section 29 of the Patent Rules, applicant is requisitioned to provide an identification of any prior art cited in respect of the corresponding United States applications and the patent numbers, if granted. Amendment to avoid references cited abroad may expedite the prosecution. If the particulars are not available to the applicant, the reason why must be stated.

The applicant stated in his letter of Sep. 3, 2001 that the European Patent Office granted the 34 claims submitted by the applicant. However, it should be noted that these claims are not the same claims as those in his European Patent. There are 35 claims in the applicant's European Patent.

In view of the foregoing defects, the applicant is requisitioned to amend the application in order to comply with the Patent Act and the Patent Rules or to provide arguments as to why the application does comply.

B.M. Brown
Patent Examiner
819-997-2167

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A door for a passenger vehicle equipped with a door frame comprising

at least two impact beams(1, 7, 1B 7B) and
at least one window guide element (6,6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a,6.1aB, 6.1ab) to guide and receive a window pane,

further comprising adjustable interlocking assemblies consisting of engaging holes and engaging keys (15.1 to 15.5a, 15.7, 15.8, 30 to 37) and engaging hooks and a reinforcing rod, the interlocking assemblies being equipped with an adjusting device in order to adjust to permissible tolerances or clearances and the vehicle is equipped with compound assemblies consisting of a vehicle door and a vehicle roof(17), a vehicle door and side rail(18), a vehicle door and post sections (8), a vehicle door (8B), and a vehicle door and transition region (21, 21T, 21h, 21x) of a passenger compartment (20),

wherein the adjustable interlocking assemblies are defined by

a) a number of engaging members arranged to the vehicle roof(17) and side rail(18) and
b) the engaging mating members are arranged to the window guide element, wherein
c) the interlocking assemblies are in a form locking connection when the vehicle door is closed by the adjusting device to adjust to the permissible tolerances,
d) for the purpose of interengagement in the state of deformation in the event of collision and interlocking due to the increase of impact energy so that all vehicle doors are always interlocked to protect passengers against ejection from the passenger compartment and/or intrusion of a deformed vehicle member and connected to the vehicle roof and side rail (18) of the vehicle frame to lower stress due to the increase of structural stiffness and the energy distribution.

2. A door according to claim 1 characterized by the arrangement of interlocking assemblies of a compound assembly: vehicle door and a vehicle member in at least two operating planes.

3. A door according to one of claims 1 or 2 characterized by the arrangement of a) the engaging member to vehicle roof (17), b) several engaging mating members to the upper part of the window guide element and to define the adjustable interlocking assemblies : reinforcing rod (17.1d) and several engaging hooks (15.6).

4. A door according to one of claims 1 to 3 characterized by the arrangement of a) the engaging member to side rail (18), b) several engaging mating members to the upper part of the window guide element and to define the adjustable interlocking assemblies: reinforcing rod (17.1d) and several engaging hooks(15.6).

5. A door according to claim 2 characterized by the arrangement of a) a number of the

engaging members to a post section having a part of the door lock and b) the engaging mating members to the window guide element of the vehicle door(8, 8B) adjacent to the post section to define the adjustable interlocking assemblies: engaging holes and engaging keys (33, 34) in two operating planes.

6. A door according to one of claims 1 to 5 characterized by the arrangement of a) at least one pair of the engaging members to both legs of a U-shaped housing (17.3, 18.3) in the common post section of vehicle doors (8, 8B) in juxtaposition and b) the engaging mating members to both window guide elements of the vehicle doors o define the adjustable interlocking assemblies: engaging holes and engaging keys (15.3, 15.3 a, 15.5, 15.5 a).

7. A door according to claim 6 wherein the U-shaped housing (17.3) connecting the vehicle doors in juxtaposition and in force locking connection with the common post section of the vehicle doors, a reinforcing panel (17.b) arranged along the vehicle roof and a transverse girder (17.2c) of the common post sections of both vehicle sides facing each other.

8. A door according to one claims 6 or 7 wherein the U-shaped housing (18.3) connecting the vehicle door , post section and vehicle sides is in force locking connection with the engaging members (15.5, 15.5 a) of the vehicle doors in juxtaposition and in force locking connection with the common post section of the vehicle door a reinforcing panel (18.1b) arranged along the side rail and a transverse girder (18.2) of the common post sections of both vehicle sides facing each other.

9. A door according claim 2 characterized by the arrangement of a number of the engaging members of interlocking assemblies to a post section whereto the vehicle door is pivotally attached and the engaging mating members to the window guide element of the vehicle door adjacent to the post section to define the adjustable interlocking assemblies: engaging holes and keys (15.1, 31, 36) in three operating planes.

10. 10A door according to one of claims 1 to 9 characterized by the arrangement of a number of the engaging members of interlocking assemblies to the passenger compartment(20) and the engaging mating members to the window guide element to define the adjustable interlocking assemblies: engaging holes and engaging keys (30, 32, 35, 37).

11. A door according to claim 8 wherein a belt case (26) is accommodated in the U-shaped housing (18.3).

12. A door according to one of claims 1 to 11 characterized by the use of one stiff U-shaped window-guide element (6, 6B), both ends of which face the lower vehicle member and the upper part of which faces the upper vehicle member for the purpose of accommodating their respective engaging members.

13. A door according to claim 12 wherein both ends of the stiff U-shaped window-guide element are force-looking connected with each other by the window-guide element.

14. A door according to one of claims1 to 11 characterized by the use of two stiff window-guide elements (6.1a,6.2a,6.1aB,6.2aB) and the respective window guides(6.1,6.2,6.1B,6.2B).

15. A door according to one of claims 1 to 11 characterized by the use of one stiff window-guide element (6,6B) and two window guides.

16. A door according to one of claims 1 to 11 wherein the vehicle roof accommodating the engaging members is reinforced by a reinforcing gate, reinforcing elements, and transverse girder of the post sections of both vehicle sides facing each other.

17. A door according to one of claims 1 to 16 wherein the engaging member comprises mechanical connection elements such as screw, rivet, washer, nut, pin, engaging rings, and an engaging hook(15.6) with interior diameter d1 and gap s1 or a sleeve (15.11) of engaging key and a washer (15.13) with outer diameter S, is provide with the adjusting device to adjust the tolerances between that engaging member and the engaging mating member from outside the vehicle.

18. A door according to claim 17 wherein the front region of the washer (15.13) has radial teeth.

19. A door according to claims 17 or 18 wherein the washer is an integral part of a screw.

20. A door according to one of claims 17 to 19 wherein the sleeve (15.11) of engaging member with exterior diameter d is governed by the condition D is greater than or equal d and less than or equal to dR where D is the exterior diameter of washer(15.13) and dR is the diameter of spacer (15.12).

21. A door according to one of claims 1 to 20 wherein the interlocking assembly comprises an engaging hole arranged in window guide element(6.1a,6.2a, 6.1aB,6.2aB) and an engaging key (15.1) rigidly attached to a reinforcing plate of the post section, whereto the transverse girder (17.2d) and reinforcing panel (17.1c) arranged along to vehicle roof or side rail are rigidly attached.

22. A door according to one of claims 1 to 21 wherein the interlocking assembly comprises an engaging key (15.2 a) rigidly attached to the block (6.11) of window-guide element (6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B) and an engaging hole arranged in reinforcing panel(17.1) arranged along the vehicle roof or side rail, where the reinforcing panel 17.1) is rigidly attached to the post section and to reinforcing plate(17.2a) and transverse girders(17.2, 17.2b) or to reinforcing plate(17.2a).

23. A door according to one of claims 1 to 22 wherein the interlocking assembly comprises an engaging hole arranged in the reinforcing panel (17.a, 18.1, 18.1a) arranged along the vehicle roof or side rail and an engaging key(15.2,15.4,15.4a) fixed to the window-guide element (6.1a,6.2a,6.3,6.4,6.1aB,6.2aB,6.3B,6.4B).

24. A door according to one of claims 1 to 23 wherein the compound assembly is provided with an interlocking assembly in which a reinforcing rod(17.1d) arranged along the vehicle member is fixed to two transverse girders(17.2e, 17.2f,o or 17.2f, 17.2g) and at least two engaging hooks(15.6) are fixed to window-guide elements (6.1a,6.2a,6.3,6.4, or 6.1aB,6.2aB ,6.3B, 6.4B).

25. A door according to one of claims 1 to 24 wherein the compound assembly: juxtaposed vehicle doors and vehicle member which is vehicle roof or side rails is provided with an interlocking assembly in which a reinforcing rod(17.1d)arranged along the vehicle member is fixed to transverse girders(17.2a, 17.2f,17.2g) and at least four engaging hooks(15.6) are fixed to window-guide elements (6.1a,6.2a,6.3,6.4,6.1aB,6.2aB,6.3B,6.4B).

26. A door according to one of claims 1 to 25 wherein the interlocking assembly comprises an engaging hole arranged in auxiliary part(6.5,6.5B) fixed to window-guide element(6,6B) and an engaging key(30,32,35) fixed to reinforcing element(21.1,21.4,21.1B) of the top transition region(21) of the passenger compartment(20).

27. A door according to one of claims 1 to 26 wherein the interlocking assembly comprises an engaging key (30,35) fixed to reinforcing element(21.2,21.2B) of the post section-transition region of the passenger compartment(20) and an engaging hole arranged in auxiliary part(6.5, 6.5B) fixed to the window-guide element(6.6B) and the impact beam(1,1B).

28. A door according to one of claims 1 to 27 wherein the interlocking assembly comprises an engaging key(30,32,35) fixed to reinforcing element (21.3,21.5,21.3B) of the bottom transition region of the passenger compartment(20) and an engaging hole arranged in auxiliary part(6.5,6.5B) fixed to window-guide element(6,6B) and auxiliary part(6.6b,6.7b,6.8).

29. A door according to one of claims 1 to 28 wherein an auxiliary part(6.5C) adapted to the outer door contour is arranged to the outer door contour to window-guide element (6,6B) and auxiliary part(6.6b,6.7b,6.8).

30. A door according to one of claims 1 to 29 wherein the interlocking assembly comprises an engaging key (37) rigidly attached to reinforcing element(21.4B,21.6B,21.5B) of the post-section-transition region of passenger compartment (2) and an engaging hole arranged in outer door-contour-shaped auxiliary part(6.5C).

31. A door according to one of claims 1 to 30 wherein the interlocking assembly comprises an engaging key (31,36) rigidly attached to auxiliary part (6.6a,6.8) of window-guide element (6,6B) and an engaging hole arranged in the post section reinforced by reinforcing element (23) and adjacent to the window guide element .

32. A door according to one of claims 1 to 31 wherein the interlocking assembly comprises an engaging key(33) rigidly attached to window-guide element(6,6B) and an engaging hole

arranged in the post section reinforced by an element (23) provide with a stud(298) of door lock(24) and adjacent to the window-guide element.

33. A door according to one of claims 1 to 32 wherein the interlocking assembly comprises an engaging key(34) rigidly attached to auxiliary part(6.7a) of window-guide element(6.6B) and an engaging hole arranged in the post section reinforced by reinforcing element(23) provide with a part of door lock and adjacent to the window-guide element.

34. A door according to one of claims 1 to 33 wherein a tailgate door(8T), hood(8h), sliding side, cargo door or trunk cover(8x) has the same features as the vehicle door.

35. A door according to one of claims 1 to 34 characterized by the use of metal, compound material, glass fibre reinforced material or no-metal material for material of the engaging member, window-guide element, auxiliary part, reenforcing element and U-shaped housing.

VEHICULE DOOR FOR CAR AND TRUCK

CROSS REFERENCE TO RELATED APPLICATIONS

This is related to an international application number PCT/DE 96/02120 (WO 97/18984, European Patent Doc. EP 0869878 B1) filed Nov. 7, 1996.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to vehicle doors and, more particularly, to interengaging assemblies which structurally integrate all vehicle doors, when closed, with the vehicle roof, both side rails (sill portions) arranged along the vehicle floor, all pillars (post sections or pillar portions) and the flanges of door apertures of a vehicle body thereby distributing energy to all those vehicular members, lowering stress thereof, preventing passenger ejection and enhancing survival chance in the event of any collision (front, side and/or rear collision) or rollover.

2. Discussion of the Prior Art:

In order to formulate in single terminology a generalized definition for the proper term is presented:

Definition:	**Proper Term:**
"*series-connected doors*"	doors of one vehicle side are series-connected
"*girder*"	panel, shell, beam etc. according to FEM and Technical Mechanics
"*window-guide channels*" of window pane (glass)	window-pane tracks **6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB**
"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body
"*mating parts of interengaging assembly*	mating parts of an interengaging assembly such as key & receptacle, hook & recess, hole & key or hook & rod
"*engaging hole*"	aperture, slot, oblong hole
"*vehicular couple*"	two mating vehicular members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & flange (transition region) of vehicle body, vehicle door & pillar/s, vehicle door & vehicle door in engagement in the event of any collision and/or rollover

It is known in the prior art to provide interengaging assemblies to engage and/or clamp the vehicle door with the mating vehicular members, when the vehicle door is in closed position, thus distributing energy, lowering stress whilst enhancing survival chance only in the event of either mid-front collision or side collision of type „U2", one of four types shown in **Fig. 13**.

VEHICULE DOOR FOR MOTOR VEHICLE

CROSS REFERENCE TO RELATED APPLICATIONS

This is related to an international application number PCT/DE 96/02120 (WO 97/18984, European Patent Doc. EP 0869878 B1) filed Nov. 7, 1996.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to vehicle doors and, more particularly, to interengaging assemblies which structurally integrate all vehicle doors, when closed, with the vehicle roof, both side rails (sill portions) arranged along the vehicle floor, all pillars (post sections or pillar portions) and the flanges of door apertures of a vehicle body thereby distributing energy to all those vehicular members, lowering stress thereof, preventing passenger ejection and enhancing survival chance in the event of any collision (front, side and/or rear collision) or rollover.

2. Discussion of the Prior Art:

In order to formulate in single terminology a generalized definition for the proper term is presented:

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"*door cavity*"	space between the outer and inner panel of the door
"*door detachment*"	vehicle door becomes detached from the vehicle body
"*mating parts of interengaging assembly*	mating parts of an interengaging assembly such as key & receptacle, hook & recess, hole & key or hook & rod
"*engaging hole*"	aperture, slot, oblong hole
"*vehicular couple*"	two mating vehicular (vehicle) members, such as vehicle door & vehicle roof, vehicle door & side rail, vehicle door & flange (transition region) of vehicle body, vehicle door & pillar/s, vehicle door & vehicle door in engagement in the event of any collision and/or rollover

It is known in the prior art to provide interengaging assemblies to engage and/or clamp the vehicle door with the mating vehicular members, when the vehicle door is in closed position, thus distributing energy, lowering stress whilst enhancing survival chance only in the event of either mid-front collision or side collision of type „U2", one of four types shown in **Fig.** 13.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A door for a motor vehicle equipped with a door frame comprising at least two impact beams **(1, 7, 1B, 7B)**,
at least one window-guide channel **(6, 6B, 6.1, 6.2, 6.1B, 6.2B, 6.1a, 6.2a, 6.1aB, 6.2aB)** to guide and receive a window pane and
interlocking assemblies, such as engaging holes and engaging keys **(15.1 to 15.5a, 15.7, 15.8, 30 to 37)** and engaging hooks **(15.6)** and a reinforcing rod **(17.1d)**, being equipped with adjusting devices to adjust to permissible tolerances or clearances, where the motor vehicle comprises vehicular couples each of which consisting of a vehicle door **(8, 8B)** and a vehicle door in juxtaposition, a vehicle roof **(17)**, side rail **(18)**, flange **(21, 21T, 21h, 21x)** of a passenger compartment **(20)** of the vehicle body or at least one post section,

characterized in that the adjustable interlocking assemblies are defined by

a) a plurality of engaging members arranged to the vehicle roof **(17)** and side rail **(18)** and
b) the engaging mating members arranged to the window-guide channel, wherein
c) the interlocking assemblies are in form-locking connection, when vehicle door is closed, by the adjusting devices to adjust to the permissible tolerances, and ensure a perfect interengagement in the state of deformation in the event of real-world accident and interlocking resulting from the increase of impact energy so that all vehicle doors are always interlocked to protect passengers against ejection from the passenger compartment and/or intrusion of a deformed vehicle member and

connected to the vehicle roof (17) and side rail (18) to lower stress due to the increasing stiffness of the vehicle body and the energy distribution to the vehicle members thereof.

2. A door according to claim 1, characterized in that the interlocking assemblies of the vehicular couple are arranged in at least two operating planes.

3. A door according to claim 1 or 2, characterized in that the reinforcing rod (17.1d) is arranged to the vehicle roof (17) and a number of engaging hooks (15.6) is arranged to the upper part of the window-guide channel.

4. A door according to one of claims 1 to 3, characterized in that the reinforcing rod (17.1d) is arranged to the side rail (18) and a number of engaging hooks (15.6) is arranged to the upper part of the window-guide channel.

5. A door according to claim 2, characterized in that a plurality of the engaging members (33, 34) of interlocking assemblies in two operating planes is arranged to the window-guide channel of the vehicle door (8, 8B) adjacent to the post section and the engaging mating members are arranged to the post section having a stud (298) of the door lock (248).

6. A door engaging according to one of claims 1 to 5, characterized in that at least one pair of the engaging members is arranged to both legs of a U-shaped housing (17.3, 18.3) in the common post section of vehicle doors (8, 8B) in juxtaposition and the engaging mating members are arranged to both window-guide channels of the vehicle doors to define the adjustable interlocking assemblies consisting of the engaging holes and engaging keys (15.3, 15.3a, 15.5, 15.5a).

7. A door according to claim 6, characterized in that the U-shaped housing **(17.3)** is in force-locking connection with the engaging members **(15.3, 15.3a)** of the vehicle doors in juxtaposition and with the common post section thereof, a reinforcing panel **(17.1b)** arranged along the vehicle roof and a transverse girder **(17.2c)** of the common post sections of both vehicle sides facing each other.

8. A door according to claim 6 or 7, characterized in that the U-shaped housing **(18.3)** is in force-locking connection with engaging members **(15.5, 15.5a)** of the vehicle doors in juxtaposition and with the common post section thereof, a reinforcing panel **(18.1b)** arranged along the side rail and a transverse girder **(18.2)** of the common post sections of both vehicle sides facing each other.

9. A door according to claim 2, characterized in that a plurality of the engaging members of interlocking assemblies in three operating planes is arranged to the post section whereto the vehicle door is pivotally attached and the engaging mating members are arranged to the window-guide channel of the vehicle door adjacent to the post section to define the interlocking assemblies consisting of the engaging holes and engaging keys **(15.1, 15,8, 31)** in three operating planes.

10. A door according to one of claims 1 to 9, characterized in that a plurality of the engaging members of interlocking assemblies is arranged to the passenger compartment **(20)** and the engaging mating members are arranged to the window-guide channel to define the adjustable interlocking assemblies consisting of the engaging holes and engaging keys **(30, 32, 35, 37)**.

11. A door according to claim 8, characterized in that a belt case (26) is accommodated in the U-shaped housing (18.3).

12. A door according to one of claims 1 to 11, characterized in that both ends of the stiff U-shaped window-guide channel (6, 6B) face the lower vehicle member and the upper part thereof faces the upper vehicle member to accommodate the respective engaging members of the interlocking assemblies.

13. A door according to claim 12, characterized in that both ends of stiff U-shaped window-guide channel (6, 6B) are force-locking connected with each other by a transverse window-guide member (6.4, 6.4B).

14. A door according to one of claims 1 to 11, characterized in that the window-guide channels (6.1, 6.2, 6.1B, 6.2B) are reinforced by two stiff window-guide members (6.1a, 6.2a, 6.1aB, 6.2aB).

15. A door according to one of claims 1 to 11, characterized in that the window-guide channels is reinforced by one stiff window-guide member (6, 6B).

16. A door according to one of claims 1 to 11, characterized in that the vehicle roof accommodating the engaging members is reinforced by a reinforcing plate, reinforcing element and transverse girder of the post sections of both vehicle sides facing each other.

17. A door according to one of claims 1 to 16, characterized in that the engaging member, comprising mechanical connection elements such as screw, rivet, washer, nut, pin, engaging rings etc. and an engaging hook (15.6) with interior diameter "d_1" and gap

"s_1" or a sleeve **(15.11)** of the engaging key and a washer **(15.13)** with outer diameter "D", is provided with the adjusting device to adjust the tolerances between the engaging member and the engaging mating member from outside the motor vehicle.

18. A door according to claim 17, characterized in that the front region of washer **(15.13)** has radial teeth.

19. A door according to claim 17 or 18, characterized in that the washer is an integral part of a screw.

20. A door according to one of claims 17 to 19, characterized in that the sleeve **(15.11)** of engaging member with exterior diameter "d" is governed by the condition "$D \geq d \geq d_R$", where "D" is the exterior diameter of washer **(15.13)** and "d_R" is the diameter of spacer **(15.12)**.

21. A door according to one of claims 1 to 20, characterized in that the interlocking assembly comprises an engaging hole arranged in the window-guide channel **(6.1a, 6.2a, 6.1aB, 6.2aB)** and an engaging key **(15.1)** rigidly attached to a reinforcing plate of the post section, whereto the transverse girder **(17.2d)** and reinforcing panel **(17.1c)** arranged along the vehicle roof or side rail are rigidly attached.

22. A door according to one of claims 1 to 21, characterized in that the interlocking assembly comprises an engaging key **(15.2a)** rigidly attached to a stiff member **(6.11)** of the window-guide channel **(6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B)** and an engaging hole arranged in a reinforcing panel **(17.1)** arranged along the vehicle roof or side rail, where the reinforcing panel **(17.1)** is rigidly attached to the post section and to

a reinforcing plate (**17.2a**) and transverse girders (**17.2, 17.2b**) or to a reinforcing plate (**17.2a**).

23. A door according to one of claims 1 to 22, characterized in that the interlocking assembly comprises an engaging hole arranged in the reinforcing panel (**17.1a, 18.1, 18.1a**) arranged along the vehicle roof or side rail and an engaging key (**15.2, 15.4, 15.4a**) fixed to the window-guide channel (**6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B**).

24. A door according to one of claims 1 to 23, characterized in that the vehicular couple is provided with an interlocking assembly, in which the reinforcing rod (**17.1d**) arranged along the vehicle member is fixed to two transverse girders (**17.2e, 17.2f** or **17.2f, 17.2g**) and at least two engaging hooks (**15.6**) are fixed to the window-guide channels (**6.1a, 6.2a, 6.3, 6.4** or **6.1aB, 6.2aB, 6.3B, 6.4B**).

25. A door according to one of claims 1 to 24, characterized in that the vehicular couple is provided with an interlocking assembly, in which the reinforcing rod (**17.1d**) arranged along the vehicle member is fixed to transverse girders (**17.2e, 17.2f, 17.2g**) and at least four engaging hooks (**15.6**) are fixed to the window-guide channels (**6.1a, 6.2a, 6.3, 6.4, 6.1aB, 6.2aB, 6.3B, 6.4B**).

26. A door according to one of claims 1 to 25, characterized in that the interlocking assembly comprises an engaging hole arranged in a housing (**6.5, 6.5B**) fixed to the window-guide channel (**6, 6B**) and an engaging key (**30, 32, 35**) fixed to the upper flange (**21**) of the passenger compartment (**20**) reinforced by a stiff member (**21.1, 21.4, 21.1B**).

27. A door according to one of claims 1 to 26, characterized in that the interlocking assembly comprises an engaging key **(30, 35)** fixed to the post-section-flange of the passenger compartment **(20)** reinforced by a stiff member **(21.2, 21.2B)** and an engaging hole arranged in the housing **(6.5, 6.5B)** fixed to the window-guide channel **(6, 6B)** and impact beam **(1, 1B)**.

28. A door according to one of claims 1 to 27, characterized in that the interlocking assembly comprises an engaging key **(30, 32, 35)** fixed to the lower flange of the passenger compartment **(20)** reinforced by a stiff member **(21.3, 21.5, 21.3B)** and an engaging hole arranged in the housing **(6.5, 6.5B)** fixed to the window-guide channel **(6, 6B)** and a retaining member **(6.6b, 6.7b, 6.8)**.

29. A door according to one of claims 1 to 28, characterized in that a door-contour-shaped member **(6.5C)** adapted to the outer door-contour is arranged to the window-guide channel **(6B)** and impact beams **(1B, 7B)**.

30. A door according to one of claims 1 to 29, characterized in that the interlocking assembly comprises an engaging key **(37)** rigidly attached to the post-section-flange of the passenger compartment **(20)** reinforced by a stiff member **(21.4B, 21.6B, 21.5B)** and an engaging hole arranged in the outer door-contour-shaped auxiliary part **(6.5C)**.

31. A door according to one of claims 1 to 30, characterized in that the interlocking assembly comprises an engaging key **(31, 36)** rigidly attached to a retaining member **(6.6a, 6.8)** of the window-guide channel **(6, 6B)** and an engaging hole arranged in the post section reinforced by an extension member **(23)** and adjacent to the window-guide channel.

32. A door according to one of claims 1 to 31, characterized in that the interlocking assembly comprises an engaging key **(33)** rigidly attached to the window-guide channel **(6, 6B)** and an engaging hole arranged in the post section reinforced by the extension member **(23)**, having the stud **(298)** of the door lock and adjacent to the window-guide channel.

33. A door according to one of claims 1 to 32, characterized in that the interlocking assembly comprises an engaging key **(34)** rigidly attached to a retaining member **(6.7a)** of the window-guide channel **(6, 6B)** and an engaging hole arranged in the post section reinforced by the extension member **(23)**, having the stud of the door lock and adjacent to the window-guide channel.

34. A door according to one of claims 1 to 33, characterized in that a tailgate door **(8T)**, hood **(8h)**, sliding side-, cargo door or trunk cover **(8x)** has the same features as the vehicle door.

35. A door according to one of claims 1 to 34, characterised in that metal, compound material, glass fibre reinforced material or non-metal material is suitable for material of the engaging member, window-guide channel, auxiliary part, reinforcing element and U-shaped housing.

connected to the vehicle roof (17) and side rail (18) to lower stress due to the increasing stiffness of the vehicle body and the energy distribution to the vehicle members thereof.

2. A door according to claim 1, characterized in that the interlocking assemblies of the vehicular couple are arranged in at least two operating planes.

3. A door according to claim 1 or 2, characterized in that the reinforcing rod (17.1d) is arranged to the vehicle roof (17) and a number of engaging hooks (15.6) is arranged to the upper part of the window-guide channel.

4. A door according to one of claims 1 to 3, characterized in that the reinforcing rod (17.1d) is arranged to the side rail (18) and a number of engaging hooks (15.6) is arranged to the upper part of the window-guide channel.

5. A door according to claim 2, characterized in that a plurality of the engaging members is arranged to the post section having a stud (298) of the door lock (248) and the engaging mating members are arranged to the window-guide channel of the vehicle door (8, 8B) adjacent to the post section to define the adjustable interlocking assemblies consisting of the engaging holes and engaging keys (33, 34) in two operating planes.

6. A door engaging according to one of claims 1 to 5, characterized in that at least one pair of the engaging members is arranged to both legs of a U-shaped housing (17.3, 18.3) in the common post section of vehicle doors (8, 8B) in juxtaposition and the engaging mating members are arranged to both window-guide channels of the vehicle